CANADIAN PETROLEUM ASSOCIATION

LAND USE REQUIREMENTS FOR ANTICIPATED HYDROCARBON DEVELOPMENT IN THE MACKENZIE DELTA-BEAUFORT SEA LAND USE PLANNING REGION

prepared for

THE CANADIAN PETROLEUM ASSOCIATION

by

R.A. OWENS ENVIRONMENTAL SERVICES LTD.

Calgary, Alberta

March, 1989

TABLE OF CONTENTS

PAGE NUMBER

TABLE OF CONTENTS

LIST OF MAPS

INTRODUCTION..... 1

BACKGROUND..... 2

THE COMMISSION'S REQUEST FOR INFORMATION..... 6

The Canadian Petroleum Association..... 6
Policies, Guidelines and Legislation..... 7
Land Use Issues and Conflicts..... 8

MAPPED INFORMATION..... 10

Development Scenarios..... 10
Production/Processing Sites..... 13
Corridors..... 46
Transmission Pipelines..... 57
Special Areas..... 61

REFERENCES CITED..... 72

APPENDICES

Appendix 1 - The Canadian Petroleum Association's Environmental Code of Practice

Appendix 2 - Petroleum Discoveries in the Mackenzie Delta-Beaufort Sea Land Use Planning Region

Appendix 3 - Illustrations of Oil and Gas Development Facilities

Appendix 4 - Checklist of Mapped Areas

LIST OF MAPS

FOLLOWS PAGE

MAP 1 - Approximate boundary of the Mackenzie Delta-Beaufort Sea land use planning region..... 2

MAP 2 - Oil and gas discoveries in the Mackenzie Delta-Beaufort Sea area..... 5

MAP 3 - Future oil and gas production areas and areas involved in past and current proposals to transport hydrocarbons..... 5

MAP 4 - Location of gas production, processing and transport facilities using a three-gas plant scenario..... 11

MAP 5 - Location of gas production, processing and transport facilities using an "industry" gas plant..... 11

MAP 6 - Location of oil production and transport facilities..... 12

MAP 7 - Location of transport corridors associated with first and second phases of gas production..... 47

MAP 8 - Location of transport corridors associated with first and second phases of oil production..... 47

MAP 9 - Harbour, support-base and communications sites..... 61

INTRODUCTION

This report has been prepared on behalf of the Canadian Petroleum Association (CPA) in response to a request for information from the Mackenzie Delta-Beaufort Sea Regional Planning Commission (the Commission). It presents details of likely land requirements for oil and gas development in the planning region based on information currently available. The information presented supplements, but does not replace, that presented in the CPA's earlier May, 1988 report to the Commission entitled "Petroleum-related Activity and Resource Potential Within the Beaufort Sea-Mackenzie Delta Land Use Planning Area" (CPA 1988). That report reviewed past oil and gas activity in the planning region and described in general terms the likely nature and scope of future development. This report responds directly to an information request made by the Commission in December, 1988 and focuses on identifying specific land areas that will be required for development of oil and gas reserves discovered in the planning region.

This report is composed of three main sections:

- a background section which briefly describes the Commission, the Commission's activities, and the CPA's previous input to the land use planning process;
- a section which includes responses to the Commission's current information requests, exclusive of mapped materials; and
- a section consisting of information sheets pertaining to land areas required for oil and gas development which have been detailed on large-scale maps and submitted separately to the Commission.

In addition, appendices are attached which present detailed information associated with oil and gas activity in the planning region.

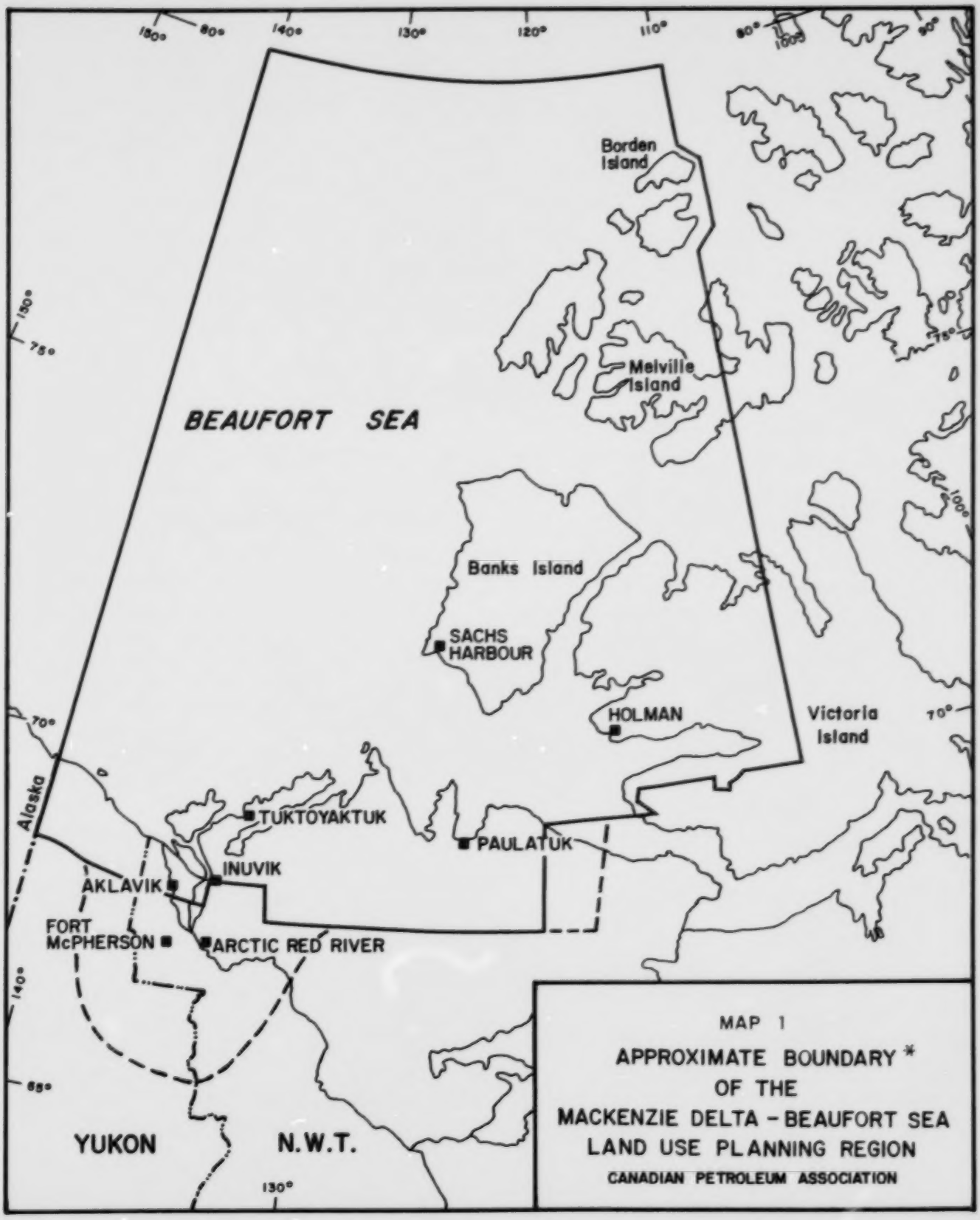
Copies of large-scale maps submitted to the Commission are on file at the CPA's Calgary offices.

BACKGROUND

Land use planning in the Northwest Territories is carried out by regional planning commissions and is coordinated by a Management Steering Committee made up of representatives from the federal and territorial governments, the Dene Nation, the Inuvialuit, the Metis Association and the Tungavik Federation of Nunavut. Regional planning commissions dealing with the Lancaster Sound region and the Mackenzie Delta-Beaufort Sea region are currently active. A Denendeh Regional Planning Commission will begin land use planning for the proposed Dene/Metis settlement area in the near future and a Nunavut Regional Planning Commission may soon be formed.

The Mackenzie Delta-Beaufort Sea Regional Land Use Planning Commission became active in 1987 and intends to produce a completed land use plan by mid-1990. To date, the Commission has completed a series of meetings and workshops with the eight communities in the planning region (Map 1), and has developed detailed maps of traditional and current land use by community residents. As a next step in the planning process the Commission wishes to identify other land users and to map lands that they use, so that a full appreciation of the scope of land use in the region can be obtained. With a catalogue of lands that are important to a full spectrum of land users in hand, the Commission intends to identify conflicting land uses and to discuss these with the parties involved. Formal discussions will take place at a series of workshops scheduled for spring and early summer, 1989. Based on workshop discussions and subsequent analyses, the Commission will formulate a regional land use plan in 1990.

The Commission first approached the CPA in spring, 1988 seeking information about land use requirements for oil and gas development in the planning region. The CPA responded by preparing a report which reviewed past and ongoing petroleum-related activity in the planning region and which described the likely scope and nature of future petroleum development.



MAP 1

APPROXIMATE BOUNDARY * OF THE MACKENZIE DELTA - BEAUFORT SEA LAND USE PLANNING REGION

CANADIAN PETROLEUM ASSOCIATION

* SEE OVER

MAP 1. The Mackenzie Delta-Beaufort Sea Land Use Planning Region includes all of the Inuvialuit Settlement Region (**heavy line**) plus an eastward extension to include Borden and Mackenzie King islands, an extension southeast of Paulatuk to include the calving grounds of the Bluenose caribou herd, and a southern extension to include the area of interest to the residents of Fort McPherson and Arctic Red River. The area included in the latter extension will become part of the Denendah Planning Region.

Source: Mackenzie Delta-Beaufort Sea Regional Land Use Planning Commission Interim Report, 1988.

The CPA's 1988 report noted that while virtually the entire planning region has the potential to produce hydrocarbons, exploration activity has to date centered on the Mackenzie Delta, the southern Beaufort Sea, and the Sverdrup Basin in the vicinity of Melville Island. Discoveries of substantial reserves of oil and gas have been made in the three areas, and as a result, future exploration and development activity is likely to remain focused there. Full development of petroleum reserves in the region will require that additional lands with hydrocarbon potential continue to be made available for exploration and that lands overlying currently known reserves be available for development and production.

The 1988 report also noted the importance to future oil and gas development of lands and waters along transport corridors leading into and out of the region. Both oil and gas pipeline systems to transport the region's hydrocarbon resources are expected to be in place before the end of the century. Transport of oil from the southern Beaufort Sea using ice-breaking tanker ships has also been considered and may follow pipeline development. A gas pipeline carrying natural gas south from the high arctic near Melville Island can be expected in the longer term.

Facilities to produce, process and transport oil and gas from the Mackenzie Delta and southern Beaufort Sea area will likely take a form that will allow development of both onshore and offshore reserves.

Gas production will most likely first involve onshore gas plants at the two major fields on Richards Island (Niglintgak and Taglu) together with a third at Parsons Lake on the mainland. Subsequent development will entail the connection of smaller onshore, and eventually offshore, reserves by extending gathering systems from the three gas plants. An alternative plan for development that is under consideration would involve a centrally located gas plant serving the three major gas fields and eventually, other smaller discoveries in both onshore and offshore areas. In both cases, a high pressure gas transmission pipeline would carry produced gas south to existing pipeline facilities in Alberta. Hydrocarbon liquids (condensate)

produced with the gas would likely also be transported south, but in a separate pipeline. Once in place, such a condensate pipeline could conceivably be used to transport oil produced with natural gas or from nearby smaller oil discoveries.

Oil reserves in the planning region will most likely be first produced from offshore wells at Gulf Canada's Amauligak discovery. Oil will be brought ashore by subsea pipeline to a terminal on northern Richards Island. As with gas development, subsequent oil development will involve connection of smaller reserves to installed processing and transport facilities. Oil produced in the region will most likely be transported south in a pipeline routed along the Mackenzie River, although tanker transport of some oil is a possibility.

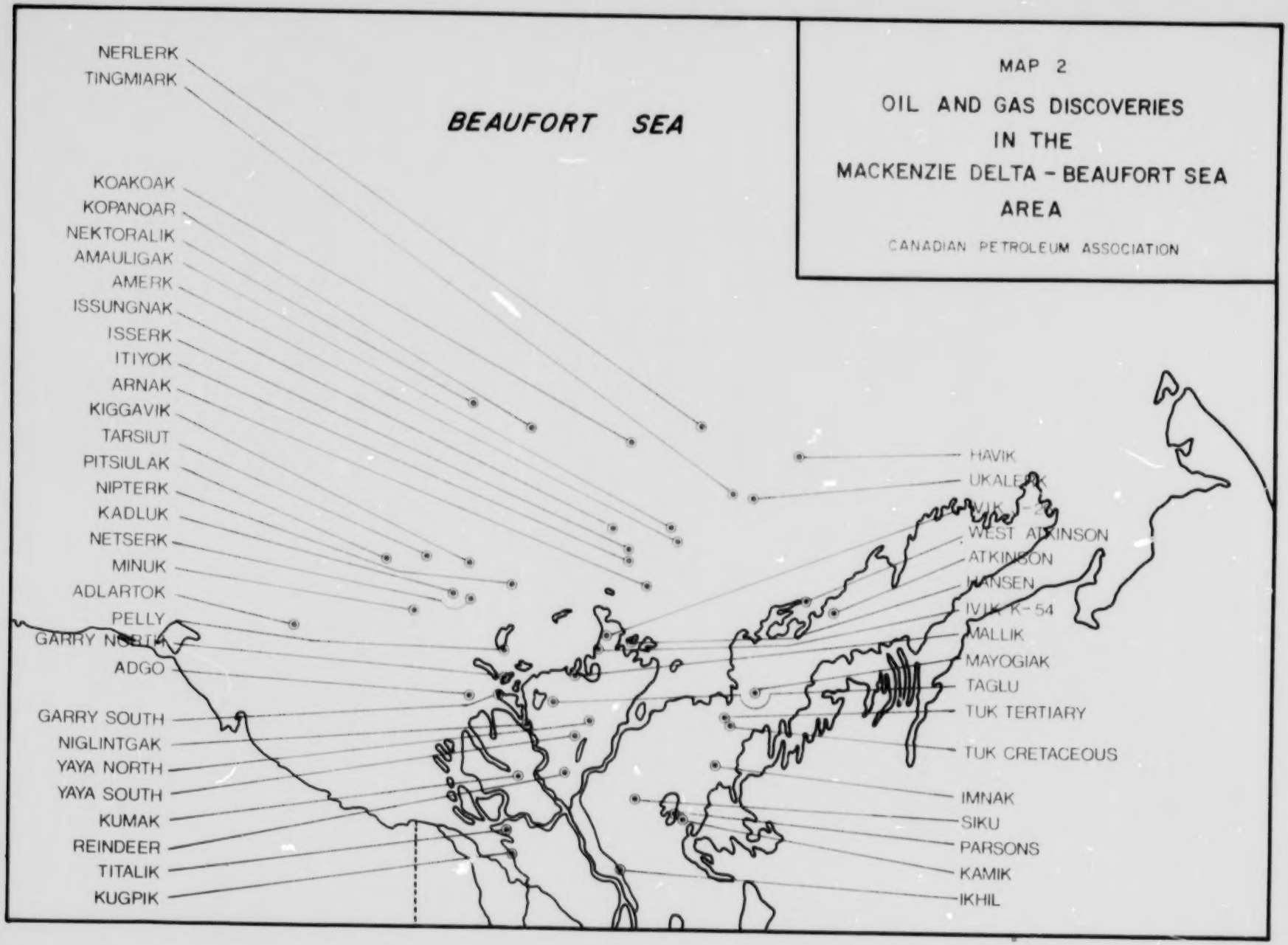
Oil and gas exploration in the region can be expected to continue and possibly accelerate as production, processing and transport developments become operational.

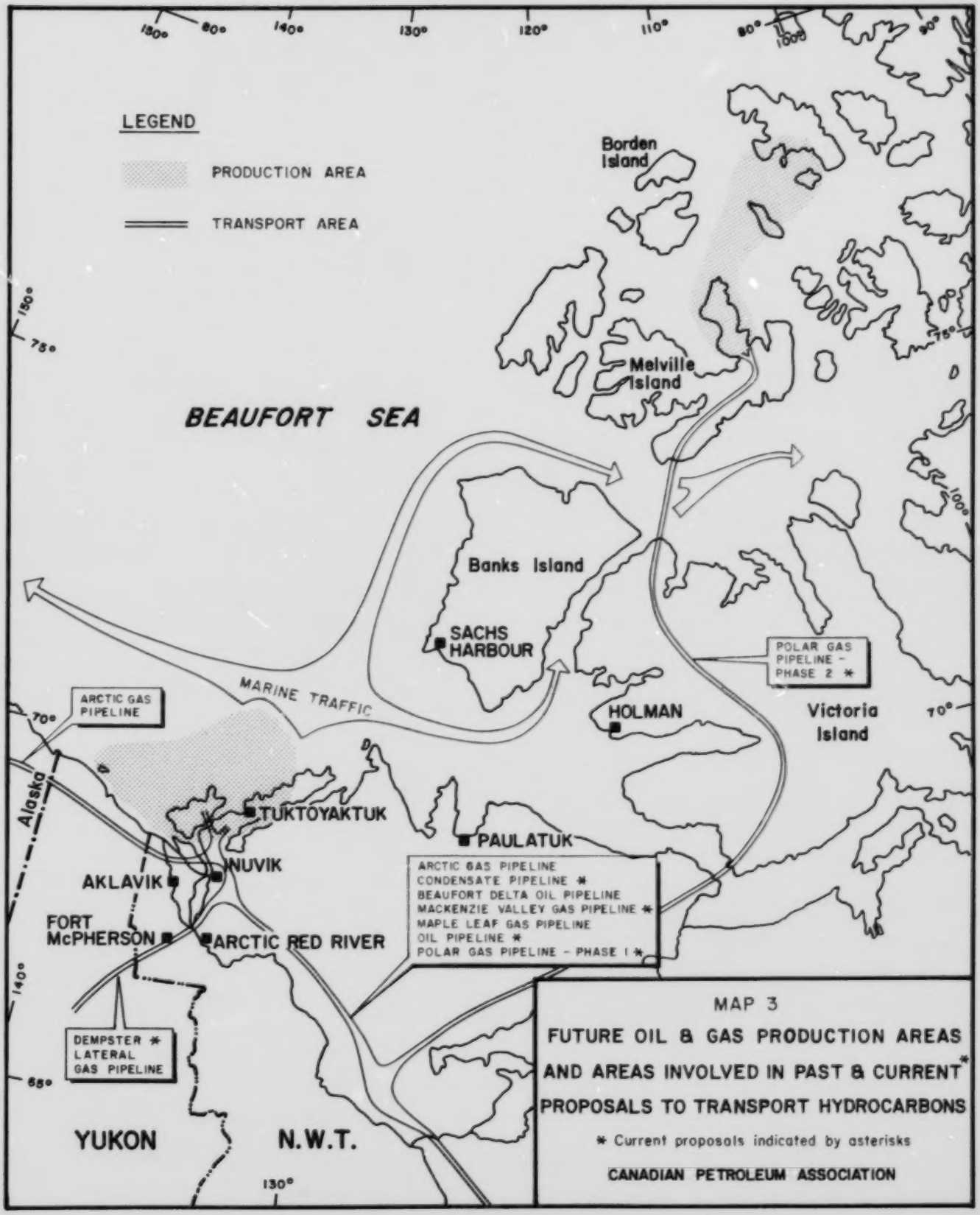
In addition to lands required directly for production, processing and transport of hydrocarbons, some other lands have unique value for future oil and gas development. Included in this latter category are: several deep-water harbour sites along the Beaufort Sea coast; main navigational channels of the lower Mackenzie River; sites particularly suited for the placement and operation of communications equipment; and a limited number of locations suited for stockpiling equipment and supplies or for use as base camps.

Two additional land uses mentioned in the CPA's 1988 report, were the mining of gravel and the disposal of hazardous wastes. Past petroleum activity in the Mackenzie Delta area has relied on the use of local supplies of gravel. In future, gravel, or lack of it, may affect the location and design of facilities required to develop the region's petroleum reserves. Gravel supply may also affect other forms of development. As development in the region proceeds, there will be increasing demands on existing supplies of gravel and intense efforts to find additional deposits. Given the

importance of gravel resources to the region, it may be appropriate for the Commission to address the matter of gravel resources from a land use planning perspective. Similarly, there has in the past been a need for the identification and management of areas for the disposal of hazardous wastes in the region. This issue might also be addressed by the Commission.

Maps illustrating the general scope of hydrocarbon development in the region and the likely location and extent of oil and gas development, which were included in the CPA's 1988 report, have been updated and are reproduced in this report. **Map** 1 shows the geographic extent of the Mackenzie Delta-Beaufort Sea Planning Region, **Map** 2 details the location of oil and gas discoveries in the southern portion of the planning region and **Map** 3 shows past and current proposals to transport hydrocarbons from the region. **Maps** 4, 5, and 6 show gas and oil development options in the Mackenzie Delta and southern Beaufort Sea, and **Maps** 7 and 8 show transport corridors likely to be used for oil and for gas development. The latter five maps have been used as the basis for detailed mapping of likely land requirements by the oil and gas industry. Those mapped areas are further described in Part Three of this report. Finally, **Map** 9 identifies a variety of land areas not associated with hydrocarbon discoveries, which are nevertheless important to oil and gas development in the region. **Maps** 4 through 9 are included in Part Three of the report.


MAP 2
OIL AND GAS DISCOVERIES
IN THE
MACKENZIE DELTA - BEAUFORT SEA
AREA
CANADIAN PETROLEUM ASSOCIATION
BEAUFORT SEA
NERLERK
TINGMIARK
KOAKOAK
KOPANOAR
NEKTORALIK
AMAULIGAK
AMERK
ISSUNGNAK
ISSERK
ITIYOK
ARNAK
KIGGAVIK
TARSIUT
PITSIULAK
NIPTERK
KADLUK
NETSERK
MINUK
ADLARTOK
PELLY
GARRY NORTH
ADGO
GARRY SOUTH
NIGLINTGAK
YAYA NORTH
YAYA SOUTH
KUMAK
REINDEER
TITALIK
KUGPIK
HAVIK
UKALERK
IVIK - 2
WEST ATKINSON
ATKINSON
HANSEN
IVIK K-54
MALLIK
MAYOGIAK
TAGLU
TUK TERTIARY
TUK CRETACEOUS
IMNAK
SIKU
PARSONS
KAMIK
IKHIL


LEGEND
PRODUCTION AREA
TRANSPORT AREA
Borden Island
Melville Island
BEAUFORT SEA
Banks Island
SACHS HARBOUR
POLAR GAS PIPELINE - PHASE 2 *
MARINE TRAFFIC
ARCTIC GAS PIPELINE
HOLMAN
Victoria Island
Alaska
TUKTOYAKTUK
PAULATUK
INUVIK
AKLAVIK
FORT McPHERSON
ARCTIC RED RIVER
ARCTIC GAS PIPELINE
CONDENSATE PIPELINE *
BEAUFORT DELTA OIL PIPELINE
MACKENZIE VALLEY GAS PIPELINE *
MAPLE LEAF GAS PIPELINE
OIL PIPELINE *
POLAR GAS PIPELINE - PHASE 1 *
DEMPSTER * LATERAL GAS PIPELINE
YUKON
N.W.T.
MAP 3
FUTURE OIL & GAS PRODUCTION AREAS AND AREAS INVOLVED IN PAST & CURRENT* PROPOSALS TO TRANSPORT HYDROCARBONS
* Current proposals indicated by asterisks
CANADIAN PETROLEUM ASSOCIATION

THE COMMISSION'S REQUEST FOR INFORMATION

In a request for information sent to potential land users not resident in the planning region, the Commission posed a series of questions. The questions involved:

- details regarding the activities of the organizations responding and land use that is contemplated;
- the existence of policies or guidelines governing land use as practiced by the organizations responding;
- the role of legislation in land use;
- anticipated land use issues or land use conflicts in the planning region; and
- suggestions or comments regarding the Commission's plans for workshops involving land users.

The Commission also asked for detailed maps showing lands presently used and lands likely to be used in future by participants.

This section of the report deals with the Commission's requests, except for those dealing with mapped information. Information supporting maps, supplied separately to the Commission, is dealt with in Part Three of the report.

THE CANADIAN PETROLEUM ASSOCIATION

The Canadian Petroleum Association (CPA) is an organization of companies engaged in oil and natural gas exploration, petroleum production and pipelining. Together, member companies produce approximately 90 percent of Canada's oil and 70 percent of the nation's gas.

A Board of Governors made up of high-ranking officers from member companies directs the affairs of the association and develops its policies. Matters unique to British Columbia, Saskatchewan, frontier areas and to pipelines, are addressed by specific divisions. Most of the association's work is carried out through the actions of standing committees that provide a focal point for member companies to address matters that affect the oil and gas industry as a whole and from which governments and the public may obtain an industry perspective. Preparation of this report was directed by the Environment Committee of CPA's Frontier Division. Firms active on the committee that gave direct input to the report include: Amoco Canada Petroleum Company Ltd., Chevron Canada Resources, Esso Resources Canada Limited, Foothills Pipe Lines (Yukon) Ltd., Gulf Canada Resources Limited, Interprovincial Pipe Line Limited, Petro-Canada Inc., Shell Canada Limited, Suncor Inc. and TransCanada PipeLines Limited.

CPA member companies obtain exploration rights to land, explore for hydrocarbons using a wide variety of geological and seismic techniques, drill exploration wells in promising areas, and produce process and transport petroleum reserves discovered. The nature and scope of petroleum activity in the Commission's area of interest has been previously described (CPA, 1988) and is reviewed in the Background section of this report.

POLICIES, GUIDELINES AND LEGISLATION

The CPA does not have a policy which specifically addresses the matter of land use. In most jurisdictions in Canada, requirements for land use planning, or restrictions on land use, are an integral component of regulatory regimes administered by federal, provincial or local authorities. Complying with the existing regulations in any jurisdiction is viewed by the CPA and its member companies simply as good operating practice. The CPA does, however, support the concept of land use planning and the member companies involved in preparing this report look forward to the completion of a well-executed land use plan for the Mackenzie Delta/Beaufort Sea region, one that is based on multiple land use concepts. Such a plan will

simplify operational preparations and generally expedite the regulatory process. The CPA is on record as supporting the Commission's efforts (CPA 1988).

A policy which in part relates to the concept of responsible land use but which focuses on the more general concept of environmental protection has been adopted by the CPA. That policy, expressed as an environmental code of practice, requires that CPA members consider environmental protection throughout their various undertakings, and specifically, that aspects of environmental concern be considered through in-house planning, consultation with government agencies and the public, compliance with the letter and spirit of applicable laws and regulations, corrective actions taken in a timely manner, development of a capacity to respond to emergency situations, and finally, through the support of relevant research. Details of the Association's environmental code are contained in Appendix 1.

The Commission, in its request for information, asked whether there was overlapping legislation which affects land use in the planning region. Clearly, that is the case. The nature and consequence of overlapping legislation that governs land use in the N.W.T., and more specifically land used for oil and gas development, has in the past been the subject of a good deal of discussion. The fact that lands within the planning region are subject to a complex regulatory regime is one important reason why the CPA supports the development of a well-considered land use plan. With a land use plan in place that is clearly recognized by both federal and territorial agencies responsible for land use, regulatory delays should be reduced.

LAND USE ISSUES AND CONFLICTS

At the outset of any land use planning process, a multitude of potential conflicts and issues is usually apparent. Identifying and dealing with such potential difficulties is the purpose of land use planning.

Member CPA companies have a good deal of experience dealing with potential conflicts between their own activities and those of other land users. That experience, which has been gained over decades in operations elsewhere in North America, suggests that careful planning, scheduling and execution of petroleum activity can successfully eliminate or avoid most conflicts with other land users. A key to successful avoidance or elimination of conflicts is communication between land use planners and land users. Workshops that have been scheduled by the Commission should encourage the kind of communication that is pre-requisite to effective planning and mitigation. Representatives of the CPA and a number of member companies plan to participate in the workshops.

The CPA believes that the land use planning effort being undertaken by the Commission can be beneficial to the region's people and to the efficient development of the region's resources. The planning process offers an opportunity for the cooperative development of a broadly based and widely accepted information base. If suitably organized and maintained, possibly through the use of computer-assisted techniques, that the information base will support land use planning, will guide and expedite industry activity and will give assurance to residents that their own needs and the region's resources are being effectively protected.

MAPPED INFORMATION

The following sections constitute a catalogue of information pertaining to maps supplied to the Commission that outline lands required for the development of petroleum resources in the planning region. Individual sections are numbered to aid in reference to mapped material. The sections are grouped so as to deal with three main categories of information:

- petroleum discovery sites where production and possibly processing will take place;
- corridors or areas between production/processing sites (above) which may be used to transport oil or gas, initially within the region to processing plants or terminals, and subsequently to market; and
- areas which are of potential value to oil and gas development because of unique characteristics or location.

Descriptions of land use which follow are based on development scenarios described in the CPA's May, 1988 report and the recent announcement by Foothills Pipe Lines (Yukon) Ltd. of plans for a Mackenzie Valley gas pipeline.

DEVELOPMENT SCENARIOS

Production of Gas Reserves

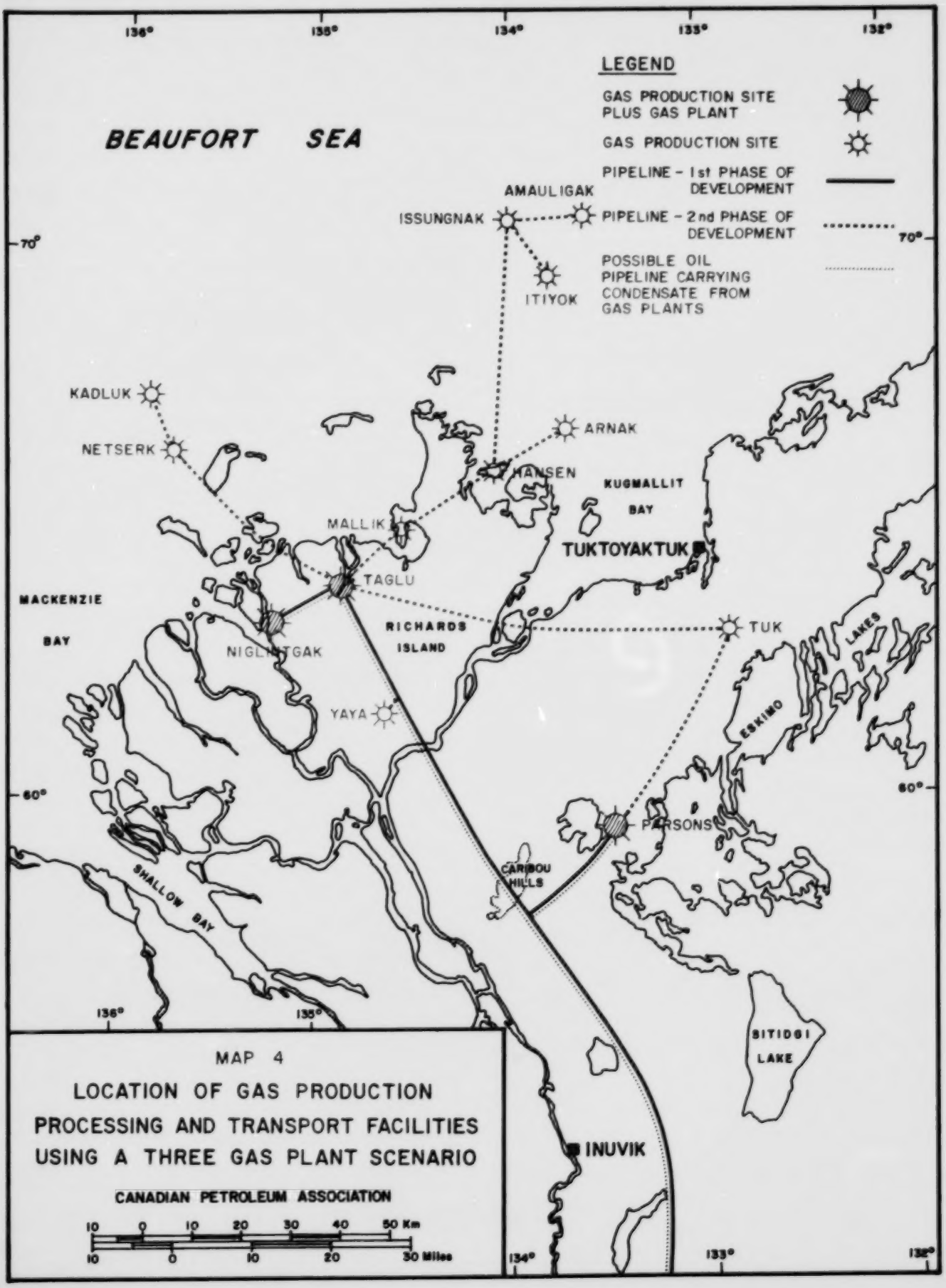
Proposals to move gas reserves from the planning region involve the construction and operation of large diameter gas transmission lines that would move gas to southern markets along one of three proposed routes. Production and processing facilities necessary to supply gas to any of the proposed gas pipeline systems would be similar in virtually all respects.

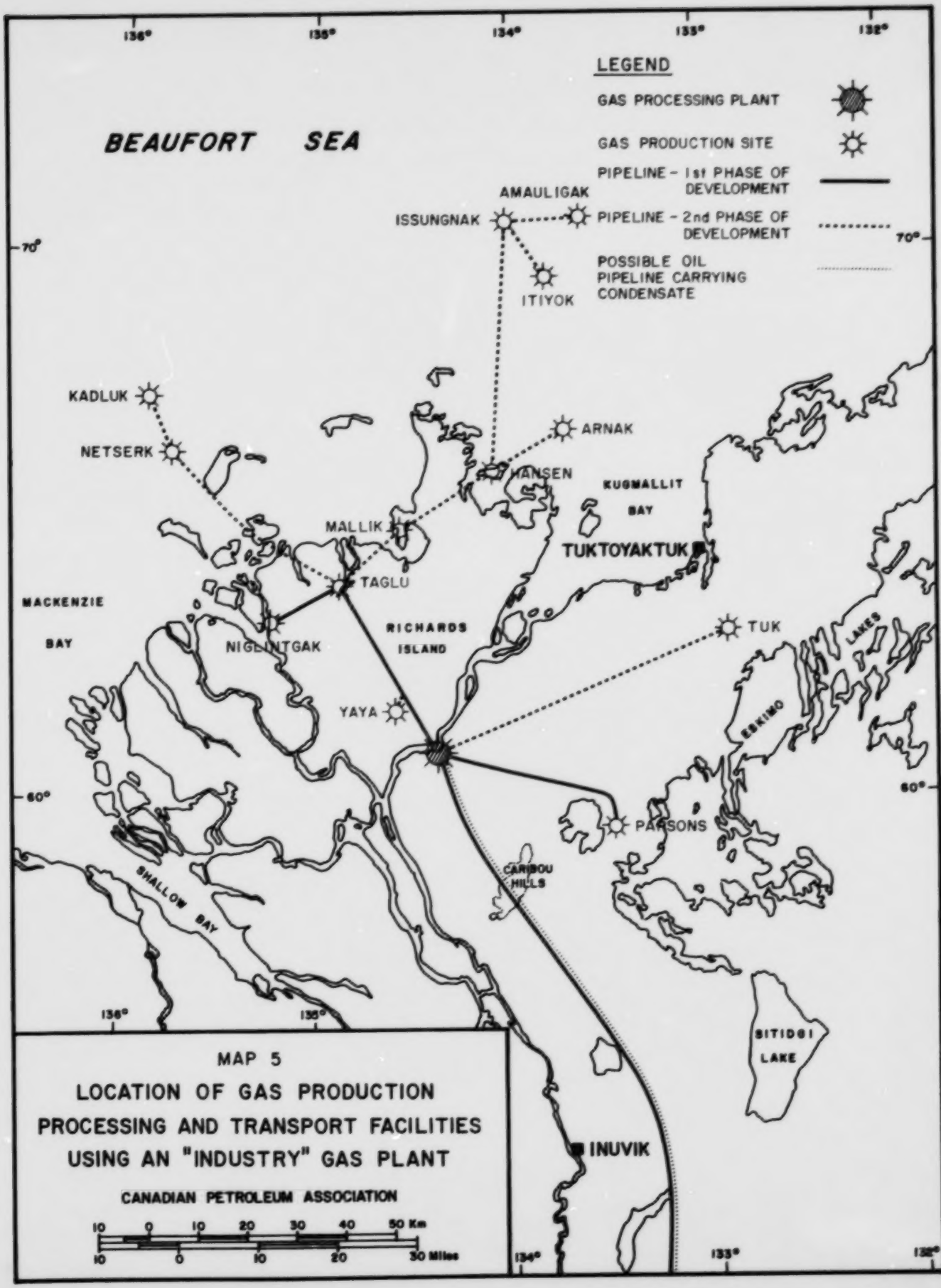
Gas production and processing facilities would likely be put in place first on land, where major discoveries have been made. Production would then, over time, be extended to include smaller mainland reserves and offshore gas fields. Once processing and transport facilities for gas are in place, greatly increased efforts to discover more gas can be expected.

A likely scenario for the first phase of gas development in the Mackenzie Delta region would see gas processing plants constructed first at Niglintgak and Taglu on Richards Island and at Parsons Lake on the mainland. Pipelines would connect the **three gas plants** to a gas transmission line to carry gas south. A separate pipeline to carry hydrocarbon liquids (condensates) produced as a by-product of gas processing would also likely be installed, if an oil pipeline capable of carrying these products were not available. Such a separate condensate pipeline would carry hydrocarbon liquids south to the Norman Wells oil pipeline. After several years of production from the three major onshore fields, (Niglintgak, Taglu and Parsons Lake) a second phase of gas development would begin and other reserves, located on both the delta and offshore, would be brought into production. Onshore reserves would likely be connected first because it would be less expensive to do so. Gas reserves which would be connected during the second phase of development could include those at Kadluk, Netserk, Issungnak, Amauligak, Itiyok, Arnak, Hansen, Tuktoyaktuk and YaYa. The approximate locations of facilities involved in such a development scenario are shown on **Map 4.**

If, as expected, oil reserves in the region are developed before or within a similar time frame as gas reserves, natural gas produced at oil production sites would be moved to gas processing facilities, or to a nearby gas pipeline. In this regard, it should be noted that the major oil discovery at Amauligak is associated with large reserves of gas.

A possible variation on the development of gas plants at Niglintgak, Taglu and Parsons would be the establishment of an **"industry"** gas plant. Currently, a site along the east channel of the Mackenzie River seems most likely but other locations may be considered in future. If an industry plant approach were to be followed, gas reserves at the three main fields


136°
135°
134°
133°
132°
LEGEND
GAS PRODUCTION SITE PLUS GAS PLANT
GAS PRODUCTION SITE
PIPELINE - 1st PHASE OF DEVELOPMENT
PIPELINE - 2nd PHASE OF DEVELOPMENT
POSSIBLE OIL PIPELINE CARRYING CONDENSATE FROM GAS PLANTS
BEAUFORT SEA
AMAULIGAK
ISSUNGNAK
ITIYOK
70°
KADLUK
NETSERK
ARNAK
HANSEN
KUGMALLIT BAY
MALLIK
TUKTOYAKTUK
TAGLU
MACKENZIE BAY
RICHARDS ISLAND
TUK
NIGLINTGAK
YAYA
ESKIMO LAKES
60°
PARSONS
CARIBOU HILLS
SHALLOW BAY
SITIDGI LAKE
INUVIK
MAP 4
LOCATION OF GAS PRODUCTION PROCESSING AND TRANSPORT FACILITIES USING A THREE GAS PLANT SCENARIO
CANADIAN PETROLEUM ASSOCIATION
10 0 10 20 30 40 50 Km
10 0 10 20 30 Miles

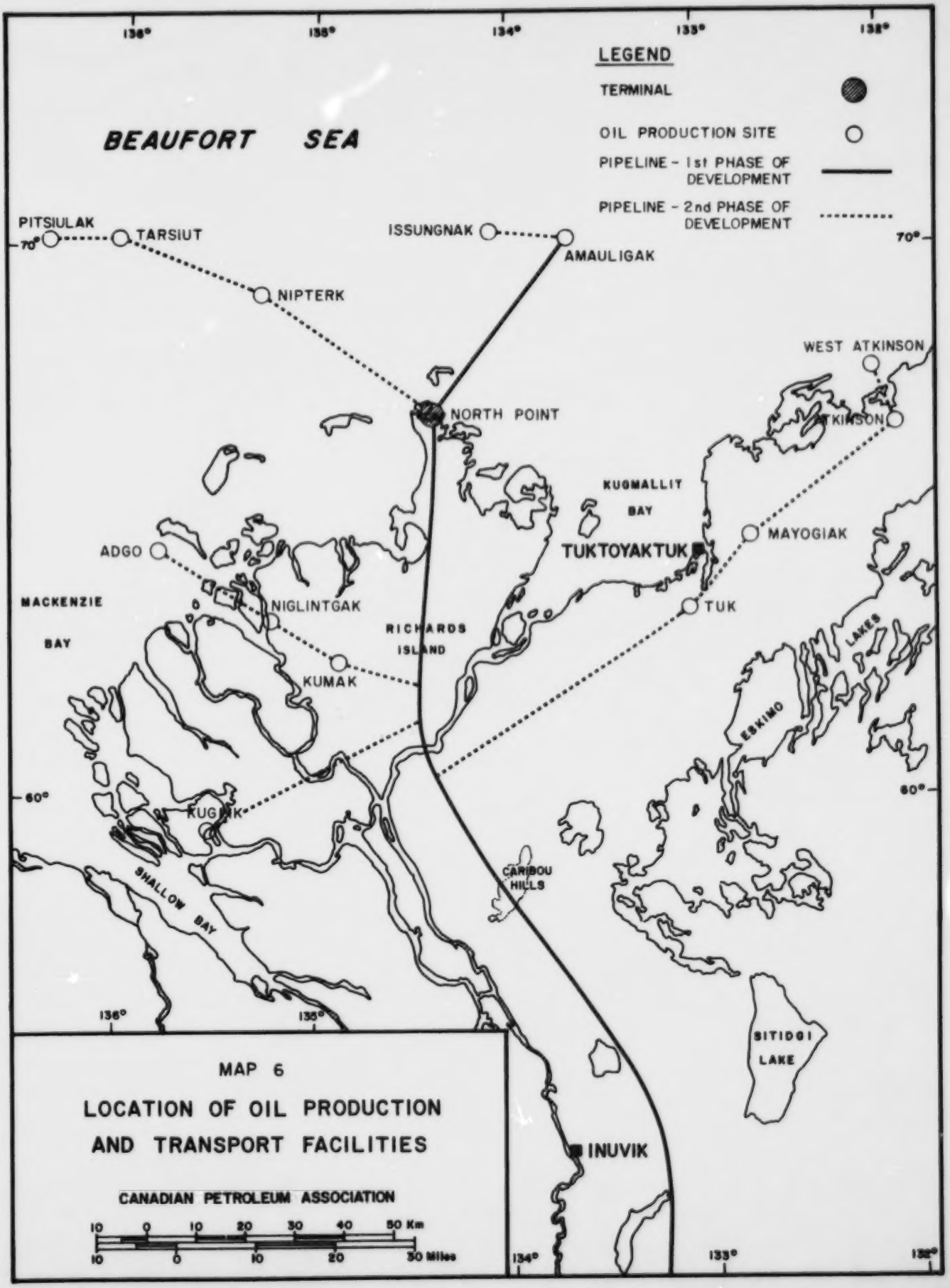

136°
135°
134°
133°
132°
LEGEND
GAS PROCESSING PLANT
GAS PRODUCTION SITE
PIPELINE - 1st PHASE OF DEVELOPMENT
PIPELINE - 2nd PHASE OF DEVELOPMENT
POSSIBLE OIL PIPELINE CARRYING CONDENSATE
BEAUFORT SEA
AMAULIGAK
ISSUNGNAK
ITIYOK
70°
KADLUK
NETSERK
ARNAK
HANSEN
KUGMALLIT BAY
MALLIK
TUKTOYAKTUK
TAGLU
MACKENZIE BAY
NIGLINTGAK
RICHARDS ISLAND
TUK
LAKES
ESKIMO
YAYA
60°
PARSONS
CARIBOU HILLS
SHALLOW BAY
SITIDGI LAKE
INUVIK
MAP 5
LOCATION OF GAS PRODUCTION PROCESSING AND TRANSPORT FACILITIES USING AN "INDUSTRY" GAS PLANT
CANADIAN PETROLEUM ASSOCIATION
10 0 10 20 30 40 50 Km
10 0 10 20 30 Miles

would be piped to the shared plant before processing. In later stages of development, other reserves, both onshore and offshore, would also be connected via gathering lines designed to carry unprocessed gas. **Map 5** illustrates the likely location of gas development facilities within the planning region if an "industry" gas plant were utilized.

Production of Oil Reserves

It is likely that development of oil reserves in the Mackenzie Delta-Beaufort Sea area will initially involve production from the major oil discovery at Amauligak. During this first phase of oil development offshore production facilities will be put in place at Amauligak, and a sub-sea pipeline will take the oil ashore. The most likely location for the offshore pipeline to make a landfall is at North Point on Richards Island (**Map 6**). Onshore facilities to receive, condition, store and pump the produced oil will be required at North Point. After production and transport systems to move oil from Amauligak are in operation a second phase of oil development would ensue, and oil reserves at nearby discovery sites would be connected, either to a receiving terminal at North Point, or through gathering lines directed to convenient points of interconnection along the oil pipeline. Discoveries likely to be connected in a second phase of development are those on land, which include Adgo, Niglintgak, Atkinson, Kumak and Kugpik. After onshore reserves are brought into production, attention would be paid to smaller discoveries offshore. Some of the latter would be connected through separate offshore gathering lines directed to North Point. Others, such as Issungnak, would be connected to North Point via existing gathering lines. The locations of facilities likely to be installed to expedite production of oil reserves in the Mackenzie Delta-Beaufort Sea are illustrated on **Map 6**.

If oil development were to be delayed until after gas development went ahead, small quantities of oil produced with the gas, and possibly that produced at oil discoveries located near gas processing facilities, would likely be transported in the condensate pipeline installed to carry petroleum liquids from gas processing plants.



MAP 6

LOCATION OF OIL PRODUCTION AND TRANSPORT FACILITIES

CANADIAN PETROLEUM ASSOCIATION

PRODUCTION/PROCESSING SITES

Oil and gas reserves have been discovered at approximately 50 different locations within the planning region (Appendix 2). At some discovery sites only a single well has been drilled, while at others several wells have been completed in an effort to define the volume and extent of petroleum reserves. Some discoveries involve both gas and oil, while others include only one or the other.

Not all reserves discovered in the region will be developed at the same time and the sequence and schedule of development will depend on several factors, not the least of which will be the nature of the initial development plan and the transport system put in place to support it. Factors affecting future development were outlined in CPA's previous report to the Commission and three potential development scenarios were identified.

Onshore Gas Production

Production and processing of oil and gas reserves in the planning region will utilize and extend techniques developed during exploration drilling. Particular efforts to minimize the size and cost of installations will be made. It is likely most production drilling will involve multiple wells directionally drilled from a small number of drilling pads. Installation of permanent roads for access to or between production centers will be avoided when possible in order to conserve costly construction materials. Gravel and other construction material will likely be reclaimed and used again as development proceeds.

Construction and operation of production and processing facilities in the Mackenzie Delta and in adjacent areas will be supported from Inuvik and Tuktoyaktuk and from a limited number of base camps and stockpile sites established along river channels. Movement of major equipment and

construction materials to production and processing sites will involve use of river barges in summer and ground-based vehicles in winter travelling over ice and snow roads. In some situations, ocean barges may also be used. Minor equipment, perishables and personnel will be moved by helicopter or fixed-wing aircraft.

Offshore Production

Development of offshore oil and gas discoveries will also utilize techniques developed during exploration drilling. Production wells and associated facilities may be placed on a variety of supporting structures. In shallow, nearshore waters, artificial islands of several types may be used, while in water of moderate depth, bottom founded structures such as Esso's caisson retained island (CRI) or Gulf's monolithic structure on a berm (MSOB) would be likely choices. In deep water, sub-sea production systems consisting of multiple production wellheads situated on the sea floor, and connected to a nearby production structure located in shallower water, may be utilized.

Construction of offshore facilities will involve the use of a variety of marine vessels and equipment supported primarily from base facilities located in Tuktoyaktuk. As development proceeds, other base camps and harbours may be established. Construction of some nearshore production sites may be completed by moving materials and equipment over ice roads in winter. Most offshore construction will, however, be completed from vessels during open-water periods. Helicopter support of construction activity will be used during all seasons.

Operation of offshore production facilities will also depend largely on marine vessels based out of Tuktoyaktuk or other harbours that may be established.

Details of Production Sites

The following descriptions of land use associated with production at hydrocarbon discovery sites in the planning region are based on the previously defined development scenarios, as well as individual reserve and site characteristics. In most cases, plans that are described have not been specifically studied and, although the land use requirements set out are believed to be reasonable, a good deal of change can be expected as detailed consideration of future production takes place. Discovery sites in the region are listed in Appendix 2.

ITEM #1 - ADGO OFFSHORE OIL AND GAS DISCOVERY

- Owner - Esso Resources Canada Limited.
- Discovery well - Adgo P-25.
- Estimated reserves $> 1.6 \times 10^6$ m^3 but $< 4.0 \times 10^6$ m^3 oil, and $< 2.8 \times 10^9$ m^3 natural gas.
- Production at the Adgo field will likely first take place during the second phase of oil development in the planning region and will involve construction of one or more artificial islands that will occupy up to 20 ha of sea bottom. Multiple production wells will be drilled directionally from each island and produced oil will be de-watered, de-gassed and transported to shore in a small diameter pipeline.
- Construction of the production island and the drilling of the first production wells will take more than one year and will be supported by marine vessels and river barges in summer and by ground vehicles travelling on ice roads in winter. Most construction activity will take place during the open water period. Helicopters will move personnel and perishables during all seasons.
- Operational activity will involve additional production drilling, well servicing, oil production and minor processing and storage of oil prior to injection into a pipeline. A small permanent operations staff will be required.
- Operational life of the facility will be in the order of 15 - 20 years.

- The plans outlined here are preliminary and have not been formally documented or subjected to detailed study.

- For further information or details contact Mr. B. Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P OH6. Telephone (403) 237-3737.

ITEM #2 - ADLARTOK OFFSHORE OIL DISCOVERY

- Owner - Amoco et al.

- Discovery well - Adlartok P-09.

- Drilling completed to date is considered insufficient to establish reserve size.

- Plans for production of the Adlartok discovery site have not been made. At some time in the future, oil reserves at Adlartok might be developed using sub-sea production methods. If an oil pipeline were available at that time, oil might at first be moved to a coastal pipeline terminus using shuttle tankers. Offshore pipelines could eventually be used to move oil ashore, if site conditions and economics were favourable. In the absence of a pipeline, oil from Adlartok could be transported from the region using tankers.

- Construction and operating activity at Adlartok, if it were to take place, would be supported by marine vessels and helicopters. Construction would most likely take place during open water periods but production activity and associated transport and support could conceivably occur throughout the year.

- The possible production approach outlined above is very tentative and is not based on formal or detailed study.

- For further information contact Mr. R. Hoos, Amoco Canada Petroleum Company Ltd., Box 200, Station M, Calgary, Alberta T2P 2H8. Telephone (403) 231-6959.

ITEM #3 -AMAULIGAK OFFSHORE OIL AND GAS DISCOVERY

- Owner - Gulf et al.

- Discovery well - Amauligak J-44.

- Amauligak is a significant oil and gas discovery which will likely be involved in the first phase of oil development in the region.

- Development at Amauligak may involve the construction of a central production and processing facility supported on a caisson retained island (C~~) or a monolithic structure on a berm (MSOB). Land (sea bottom) directly affected by the production support structure would amount to approximately 20 ha. A number of production wells would be drilled directionally from the production structure and facilities to treat and store produced oil and to pump it to a pipeline leading ashore would also be put in place. An artist's drawing of an offshore production facility is included in Appendix 3.

- Construction of the production facilities and the associated 500 mm sub-sea pipeline will be supported by marine vessels, including some capable of ice-breaking. Construction will extend over three years and will involve placement of shallow water portions of the sub-sea pipeline during winter. Helicopters will be used to support construction during all seasons.

- Operational activity will involve production drilling, well servicing, conditioning produced oil, re-injection or flaring of produced gas and storage and pumping of produced oil.

- Operational life of the Amauligak production facility is expected to approach 25 years.

- Operational activity will be supported by marine traffic and helicopters on a year-round basis.

- Plans outlined here are preliminary and have not been formally documented or subjected to detailed study.

- For further details contact Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

ITEM #4 - AMERK OFFSHORE GAS DISCOVERY

- Owner - Esso Resources et al.

- Discovery well - Amerk O-09.

- Estimated reserves $< 2.8 \times 10^9$ m^3 natural gas.

- This relatively small offshore gas discovery will likely not be included in the first or second phase of gas development planned for the region. When the reserve is developed, production facilities similar to those described for the Itiyok gas discovery (see Item # 15) might be utilized.

- For additional or updated information contact Mr. B. Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P OH6. Telephone (403) 237-3737.

ITEM #5 - ARNAK OFFSHORE OIL AND GAS DISCOVERY

- Owner - Esso et al.
- Discovery well - Arnak L-30.
- Estimated reserves > 1.6×10^6 m^3 oil, and
  < 2.8×10^9 m^3 natural gas.
- Production of reserves at Arnak will likely occur during the second phase of gas development in the region. Production at Arnak will involve a caisson retained structure or artificial island from which at least three production wells will be directionally drilled. A simple gas processing facility to de-water the produced gas will also be required.
- Construction of the production structure will take place during the open-water period and will be supported primarily by marine vessels. Crews and perishables will be moved by helicopter.
- Operational activity at the site will involve producing, conditioning and compressing gas for transport to onshore gas processing facilities via a pipeline. It is expected there will be few, if any, permanant staff once the facility is in operation.
- Operational life of the production facility at Arnak is anticipated to be less than 15 years.
- Operation of the Arnak facility will be supported by marine vessels and barges during periods of open-water and by helicopters during all seasons.
- Upon reservoir depletion the production facility, including the supporting structure, will be removed.
- Plans outlined here are preliminary and have not been formally documented or subjected to detailed study.
- Further details may be obtained by contacting Mr. B. Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P 0H6. Telephone (403) 237-3737.

ITEM #6 - ATKINSON ONSHORE OIL DISCOVERY

- Owner - Esso Resources Canada Limited.
- Discovery well - Atkinson H-25.
- Estimated reserves > $1.6 \times 10^6 m^3$ but < $4.0 \times 10^6 m^3$ oil.

- Production of oil reserves at the Atkinson discovery site will likely take place during the second phase of oil development in the region and will involve construction of one or more gravel pads from which multiple production wells will be directionally drilled. Approximately 25 ha of land, at or near the discovery site, will be directly affected by oil production facilities. Produced oil will be de-watered and injected into a pipeline. Produced water will be disposed of by injection into disposal wells drilled for that purpose. Oil at Atkinson will likely be produced in conjunction with a nearby offshore oil discovery at West Atkinston (see Item #45).

- Construction of the gravel pads and placement of production equipment will be completed in one year. Gravel and construction material will be transported to the site over winter ice and snow roads. Construction of production facilities and initial production drilling will continue year-round. Personnel, perishables and minor equipment will be moved by helicopter during all seasons.

- Operational activity will involve additional production drilling, well servicing, oil production and minor processing (de-watering). Produced oil will be stored prior to transport by pipeline. A small permanent operating staff is anticipated.

- Production at Atkinson may continue for 15 - 20 years.

- Plans outlined here are preliminary and have not been formally documented or subjected to detailed study.

- For further information or details contact Mr. B. Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P OH6. Telephone (403) 237-3737.

ITEM #7 - GARRY SOUTH ONSHORE OIL AND GAS DISCOVERY

- Owner - Suncor et al.

- Discovery well - Garry P-04.

- Estimated reserves for the Garry P-04 discovery and the closely associated Garry G-07 discovery (see Item #8) are:

  3.5×10^6 m^3 oil, and
  8.7×10^9 m^3 natural gas.

- Reserve estimates are preliminary as drilling so far completed has not been sufficient to delineate the reservoirs.

- Production from the two Garry discovery sites would likely be coordinated. The two sites are located on islands which are

several kilometres north of the major gas discovery at Niglintgak. Production at Niglintgak, scheduled for the first phase of gas development in the region, would likely spur development at the Garry sites. Both oil and gas might be produced.

- Production of the Garry reserves would likely be from drilling pads located onshore from which wells would be directionally drilled. Gathering lines, placed in shallow water and onshore, would carry produced hydrocarbons to control and processing facilities.

- Most construction activity would take place during the open-water period and would take more than one year to complete. Support of construction would involve marine vessels and river barges in summer and ground vehicles travelling on ice roads in winter. Helicopters would move personnel and perishables in all seasons.

- Operational activity at Garry production sites will involve drilling a minimum of two delineation wells and 10 - 25 development wells.

- Production at the Garry sites may continue for more than 15 years.

- Plans outlined here are preliminary and have not been formally documented or subjected to detailed study.

- For further information or details contact Mr. George Eynon, Suncor Inc., Resources Group, 500-4th Avenue S.W., Calgary, Alberta T2P 2V5. Telephone (403) 269-8638.

ITEM #8 - GARRY NORTH ONSHORE GAS DISCOVERY

- Owner - Suncor et al.

- Discovery well - Garry G-07.

- Production at the Garry G-07 site will likely be combined with production at Garry P-04 (see Item #7). Plans for the two sites are outlined under Item #7 above.

- For further information contact Mr. George Eynon, Suncor Inc., 500-4th Avenue S.W., Calgary, Alberta. T2P 2V5. Telephone (403) 269-8638.

ITEM #9 -HANSEN ONSHORE OIL AND GAS DISCOVERY

- Owner - Esso et al.
- Discovery well - Hansen G-07.
- Estimated reserves $< 1.6 \times 10^6$ m^3 oil, and
  $< 2.8 \times 10^9$ m^3 natural gas.
- Production at the Hansen discovery site is anticipated during the second phase of gas development in the region and will likely involve a well pad (gravel) from which at least three production wells will be directionally drilled. A simple gas processing facility to remove water from the produced gas will also be required.
- Land required for production at the site will likely include 20 - 30 ha in the immediate vicinity of the discovery well.
- Construction of production facilities at Hansen will be completed over a two-year period. Major equipment, construction materials and consumables will be moved to the site using river barges during open-water periods or by using ground-based vehicles over ice roads in winter. Work crews and perishables will be moved by helicopter.
- Operational activity will involve producing, conditioning and compressing gas for transport by pipeline to a gas processing plant. Production activity will require few, if any, permanent staff.
- Operational life of the Hansen production facility is expected to be less than 15 years.
- During operation, the Hansen production facility will be supported by marine vessels and river barges. In winter, ground-based vehicles moving over ice roads will be used for support. Helicopter support will likely be used during all seasons.
- Upon reservoir depletion, the production facility will be removed.
- Plans outlined here are preliminary and have not been formally documented or subjected to detailed study.
- For further information or details contact Mr. B. Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P OH6. Telephone (403) 237-3737.

ITEM #10 - HAVIK OFFSHORE OIL DISCOVERY

- Owner - Amoco et al.
- Discovery well - Havik B-41.
- Drilling results currently available are not considered sufficient to estimate reserve size.
- Plans for production of the Havik oil discovery have not been made. When production does occur it might involve the use of a bottom founded structure, but this will depend upon site conditions and additional experience gained in Beaufort Sea operations. Construction at the site and the transport of produced oil might take the general form described for oil production at the Adlartok discovery (see Item #2).
- Plans outlined here are tentative and are not based on formal studies.
- For further information contact Mr. R. Hoos, Amoco Canada Petroleum Company Ltd., Box 200, Station M, Calgary, Alberta T2P 2H8. Telephone (403) 231-6959.

ITEM #11 - IKHIL ONSHORE GAS DISCOVERY

- Owner - Gulf Canada Resources Limited and Mobil Oil Canada.
- Discovery well - Ikhil I-37.
- This is a small gas discovery not likely to be included in the initial phases of gas development in the region.
- When the Ikhil discovery site is developed, production facilities, construction and support similar to that described for the Siku and Parsons discoveries could be utilized.
- For further information contact Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

ITEM #12 - IMNAK ONSHORE OIL DISCOVERY

- Owner - Esso et al.
- Discovery well - Imnak J-19.
- Estimated reserves $< 1.6 \times 10^6 m^3$ oil.

- It is unlikely that the Imnak oil discovery will be developed during the first or second phase of oil development in the region. Production of oil at Imnak will involve construction of one or more gravel pads from which multiple production wells will be directionally drilled. Approximately 25 ha of land, at or near the discovery site, will be directly affected by oil production.

- Construction method, timing and support, as well as operational activity at Imnak, will likely be similar to that described for the Atkinson onshore oil discovery (see Item #6).

- Plans outlined here are preliminary and have not been formally documented or subjected to detailed study.

- For further information or details contact Mr. B. Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P OH6. Telephone (403) 237-3737.

ITEM #13 - ISSERK OFFSHORE GAS DISCOVERY

- Owner - Esso et al.

- Discovery well - Isserk E-27.

- Estimated reserves $< 2.8 \times 10^9$ m^3 natural gas.

- This relatively small offshore gas discovery is unlikely to be included in the initial phases of gas development planned for the region. When the reserve is developed, production facilities similar to those described for Itiyok will likely be utilized.

- For additional or updated information, contact Mr. B. Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P OH6. Telephone (403) 237-3737.

ITEM #14 - ISSUNGNAK OFFSHORE OIL AND GAS DISCOVERY

- Owner - Esso et al.

- Discovery well - Issungnak O-61.

- Estimated reserves $> 4 \times 10^6$ m^3 oil, and
  $> 28 \times 10^9$ m^3 but $< 56 \times 10^9$ m^3 natural gas

- Production of Issungnak gas reserves will likely take place during the second phase of gas development in the planning region. Production is likely to involve a caisson retained structure from which at least 12 production wells will be directionally drilled. A simple gas processing facility to remove water from produced gas will also be required. Production of oil reserves at Issungnak is

also expected, and would likely occur as part of a second phase of oil development in the region. Oil production would involve a similar production structure and similar directional drilling of multiple wells. Production of oil and gas from the same supporting structure is likely, although one or the other would be produced exclusively during the initial stages of development at the site.

- Land (sea-bottom) required for production facilities at Issungnak will be in the order of 20 ha in the vicinity of the two discovery wells.

- Construction of the production facility will take place during the open-water period and will be supported primarily by marine vessels. Crews and perishables will be moved by helicopter.

- Operational activity will likely involve producing and conditioning oil and gas for transport by pipeline to an onshore facility. The production facility will be operated with a small permanent staff.

- Operational life of the production facility at Issungnak will be from 10 to 20 years.

- Operational activity will be supported by marine vessels and barges during open-water periods and by helicopters during all seasons.

- Upon reservoir depletion, the production facilities and supporting structure will likely be removed.

- Plans outlined above are preliminary and have not been formally documented or subjected to detailed study.

- For further information or details contact Mr. B. Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P OH6. Telephone (403) 237-3737.

ITEM #15 - ITIYOK OFFSHORE OIL AND GAS DISCOVERY

- Owner - Esso et al.

- Discovery well - Itiyok I-27.

- Estimated reserves $< 1.6 \times 10^6$ m^3 oil, and
  $> 2.8 \times 10^9$ m^3 but $< 28.2 \times 10^9$ m^3 natural gas.

- Given the production scenarios that are currently considered likely, production of gas from the Itiyok discovery site will likely occur as part of the second phase of gas development in the region. Oil production from the site is not likely in the foreseeable future. Production of gas reserves at Itiyok will probably involve a caisson retained structure or an artifical

island from which at least three production wells will be directionally drilled. A simple gas processing facility to remove water from produced gas will also be required.

- Production of oil at Itiyok would involve a similar support structure to that proposed for gas production (above). Both oil and gas could conceivably be produced simultaneously, if suitable transport for oil was available. Itiyok is not included in the first or second phases of oil production that is presently anticipated.

- Land required for production facilities will be on the order of 20 ha in the immediate vicinity of the discovery site.

- Construction of the caisson retained structure will take place during the open-water period and will be supported primarily by marine vessels. Crews and perishables will be moved by helicopters.

- Operational activity will involve producing, conditioning and compressing gas for transport by pipeline to an onshore gas processing plant. A single rig will drill production wells and service those already in production. The production facility will likely be operated by a small permanent staff.

- Operational life of the Itiyok gas production facility is expected to be less than 10 years.

- Operations at Itiyok will be supported by marine vessels and barges during open-water periods. Helicopter support will be utilized during all seasons.

- Upon reservoir depletion, production equipment and the supporting structure will likely be removed.

- Plans outlined above are preliminary and have not been formally documented or subjected to detailed study.

- For further information or details contact Mr. B. Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P 0H6. Telephone (403) 237-3737.

ITEM #16 - IVIK J-26 ONSHORE OIL AND GAS DISCOVERY

- Owner - Esso Resources Canada Limited.

- Discovery well - Ivik J-26.

- Estimated reserves $< 1.6 \times 10^6$ m^3 oil, and
  $< 2.8 \times 10^9$ m^3 natural gas.

- A small onshore oil and gas reserve that could be included in the second phase of oil and/or gas development in the region. When developed, production facilities would likely be similar to those described for Hansen and Mallik for gas (see Items #9 and #25), or to Atkinson for oil (see Item #6).

- Plans outlined here are preliminary and have not been formally documented or subjected to detailed study.

- For further information or details contact Mr. B. Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P OH6. Telephone (403) 237-3737.

ITEM #17 - IVIK K-54 ONSHORE OIL DISCOVERY

- Owner - Esso Resources Canada Limited.

- Discovery well - Ivik K-54.

- Estimated reserves $< 1.6 \times 10^6$ m^3 oil.

- A small onshore oil reserve likely to be included in the second phase of oil development. When the discovery is developed, production facilities and the approach to construction and operation will probably be similar to those described for the Atkinson oil discovery (see Item #6). Ivik K-54 will likely be developed in conjunction with the nearby oil and gas discovery at Ivik J-26 (see Item #16).

- Plans outlined here are preliminary and have not been formally subjected to detailed study.

- For further information contact Mr. Brian Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P OH6. Telephone (403) 237-3737.

ITEM #18 - KADLUK OFFSHORE GAS DISCOVERY

- Owner - Esso et al.

- Discovery well - Kadluk O-07.

- Estimated reserves $> 2.8 \times 10^9$ m^3 but $< 28 \times 10^9$ m^3 natural gas

- Production of the Kadluk discovery is likely to occur during the second phase of gas development in the region. Production at the site will involve a caisson retained structure or an artificial island from which at least eight production wells will be directionally drilled. A simple gas processing facility to remove water from the produced gas will also be required.

- Land (sea-bottom) required for production facilities will directly involve 20 ha in the immediate vicinity of the discovery well.

- Construction of the production structure for Kadluk will be during the open-water period and will be supported primarily by marine vessels. Crews and perishables will be moved by helicopters during all seasons.

- Operational activity will involve producing, conditioning and compressing gas for pipeline transport to an onshore processing plant. The Kadluk production facility may be operated remotely or possibly by a very small permanent staff.

- Operational life of the facility will likely be less than 15 years.

- Operations at Kadluk will be supported by marine vessels and barges during open-water periods. Helicopters will be used during all seasons.

- Upon depletion of the reserve, production equipment and supporting structures will likely be removed.

- The plans outlined here are preliminary and have not been formally documented or subjected to detailed study.

- For further information or details contact Mr. B. Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P 0H6. Telephone (403) 237-3737.

ITEM #19 - KAMIK ONSHORE OIL DISCOVERY

- Owner - Gulf Canada Resources Limited and Mobil Oil Canada.

- Discovery well - Kamik D-58.

- Reserves at the Kamik discovery are described as "minimally significant".

- The Kamik discovery is located near Parsons Lake and as a consequence development of this relatively small oil reservoir would likely follow development of Parsons gas reserves and the establishment of a gas plant. Oil from Kamik would be transported by pipeline to the Parsons Lake gas plant and would be injected into the gas plant condensate stream for transport to Norman Wells.

- Construction and operational activities at Kamik would likely be similar to those outlined for the development of the Parsons gas field (see Item #33).

- The operational life of production facilities at Kamik is expected to be approximately 10 years.

- For further details contact Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

ITEM #20 - KIGGAVIK OFFSHORE GAS DISCOVERY

- Owner - Amoco et al.

- Discovery well - Kiggavik A-43.

- Only gas was found at the Kiggavik discovery well, although both oil and gas were present in the nearby Tarsiut discovery wells that are believed to be part of the same petroleum reservoir. Drilling information available is not sufficient to support estimation of gas reserves at Kiggavik.

- Plans for production of gas at the Kiggavik discovery site have not been made.

- For further information contact Mr. R. Hoos, Amoco Canada Petroleum Company Ltd., Box 200, Station M, Calgary, Alberta T2P 2H8. Telephone (403) 231-6959.

ITEM #21 - KOAKOAK OFFSHORE OIL AND GAS DISCOVERY

- Owner - Amoco et al.

- Discovery well - Koakoak O-22.

- Drilling completed to date is considered insufficient to accurately estimate reserves.

- Plans for production at the Koakoak discovery site have not been made. Water depth at the site is near the current limit for bottom founded production structures, so either a sub-sea production system or a bottom founded support structure could conceivably be used when future production is considered. Eventual scheduling and support of construction and operations at the Koakoak site might be similar to that described for the Adlartok discovery (see Item #2) but could vary, depending upon site conditions and economic factors.

- Plans outlined here are tentative and are not based on detailed studies.

- For further information contact Mr. R. Hoos, Amoco Canada Petroleum Company Ltd., Box 200, Station M, Calgary, Alberta T2P 2H8. Telephone (403) 231-6959.

ITEM #22 - KOPANOAR OFFSHORE OIL AND GAS DISCOVERY

- Owner - Amoco et al.
- Discovery well - Kopanoar M-13.
- Drilling information currently available is insufficient to establish reserve size.
- Plans have not been made for production of either oil or gas at the Kopanoar discovery site. Water depth is greater than 50 m, a factor which suggests eventual production at the site might take the general form outlined for the Adlartok discovery site (see Item #2).
- Further or updated information may be obtained from Mr. R. Hoos, Amoco Canada Petroleum Company Ltd., Box 200, Station M, Calgary, Alberta T2P 2H8. Telephone (403) 231-6959.

ITEM #23 - KUGPIK ONSHORE OIL DISCOVERY

- Owner - Shell Canada Limited.
- Discovery well - Kugpik O-13.
- Estimated reserves $> 1.5 \times 10^6$ m^3 but $< 3.0 \times 10^6$ m^3 oil.
- Production of oil from the Kugpik discovery will likely take place during the second phase of oil development in the planning region. Production facilities would include production wells, a gathering system, a central treating facility and a trunkline to the mainline oil pipeline.
- Land area required for production at Kugpik would be $<$ 10 ha.
- Facilities at Kugpik will likely be constructed in winter and would be supported by ground-based vehicles travelling over ice roads.
- Operational activity would be similar to that described for Niglintgak (see Item #30). Operational life of the facility would likely be more than 25 years.
- Upon completion of oil production, surface facilities will be dismantled and the ground surface reclaimed. Sub-surface lines will be abandoned and wells plugged.

- Plans outlined here are preliminary and additional studies to better define the scale, location and nature of production facilities are required.

- For further information contact A.B. Anderson, Senior Staff Petroleum Engineer, Oil and Gas Business Development, Shell Canada Limited, 400-4th Avenue S.W., Calgary, Alberta T2P 2H5. Telephone (403) 232-3257.

ITEM 24 - KUMAK ONSHORE OIL AND GAS DISCOVERY

- Owner - Shell Canada Limited and Gulf Canada Resources Limited.

- Discovery well - Kumak J-06.

- Estimated reserves $> 3x10^6$ m^3 but $< 6.0x10^6$ m^3 oil, and approximately $1.6x10^9$ m^3 natural gas.

- Production of gas from the Kumak discovery is anticipated during the second phase of gas development in the region and would likely closely follow and be associated with gas development at the Niglintgak discovery (see Item #31). Oil production from Kumak is also expected during the second phase of oil development.

- Facilities for gas production at the Kumak discovery will include two well sites, a gathering system and an 8 km gathering pipeline to carry gas to the Niglintgak gas plant. Facilities for producing oil would include additional well sites, a gathering system and a central treating plant.

- Land areas involved in possible oil and gas development have not been calculated but would be less than 10 ha.

- Production facilities would be constructed in winter and would be supported by ground-based vehicles travelling over ice roads on river channels.

- Operational activity would be similar to that described for Niglintgak (see Item #31).

- Plans for possible development described above are preliminary and further studies to define the scale, location and nature of facilities are required.

- Additional information may be obtained from A.B. Anderson, Senior Staff Petroleum Engineer, Oil and Gas Business Development, Shell Canada Limited, 400-4th Avenue S.W., Calgary, Alberta T2P 2H5. Telephone (403) 232-3257.

ITEM #25 - MALLIK ONSHORE GAS DISCOVERY

- Owner - Esso Resources Canada Limited.
- Discovery well - Mallik L-38.
- Estimated reserves > 2.8×10^9 m^3 but < 28.2×10^9 m^3 natural gas.
- Production at the Mallik discovery will likely involve a well pad from which at least three production wells will be directionally drilled, together with a simple gas processing (de-watering) facility. Current production scenarios suggest gas at the Mallik site will be produced during the second phase of gas development in the planning region.
- Land required for production will be in the order of 20 - 30 ha in the immediate vicinity of the discovery well.
- Construction of production facilities will take two years. Major components and construction materials will be moved by river barge to a nearby staging location and then moved to the Mallik site in winter over ice roads.
- Operational activity will involve drilling the required production wells, servicing producing wells, de-watering produced gas and compressing gas for transport through a gathering pipeline to the nearest gas processing facility. There will be few, if any, permanent staff at the site during normal operating periods.
- Water removed from the raw gas will be injected into a disposal well drilled for that purpose.
- Operational life of production facilities will likely be less than 15 years.
- During operation the facility will be supported by ground-based vehicles over winter ice roads from nearby support bases and by helicopter during all seasons.
- Upon depletion of gas reserves at the site, production facilities will likely be removed.
- Plans outlined are preliminary and have not been formally documented or subjected to detailed study.
- For further details contact Mr. B. Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P OH6. Telephone (403) 237-3737.

ITEM #26 - MAYOGIAK ONSHORE OIL DISCOVERY

- Owner - Esso et al.
- Discovery well - Mayogiak J-17.
- Estimated reserves $> 1.6 \times 10^6$ m^3 but $< 4.0 \times 10^6$ m^3 oil.
- Production of oil reserves at the Mayogiak discovery will involve construction of one or more gravel pads from which multiple production wells will be directionally drilled. Approximately 20 ha of land will be directly affected by oil production facilities. Oil at Mayogiak will likely be produced during the second phase of oil development in the region.
- Construction approach, timing and support, as well as operational activity at Mayogiak, will likely be similar to that described for the Atkinson onshore oil discovery (see Item #6).
- Plans outlined here are preliminary and have not been subjected to detailed study.
- For further information or details contact Mr. B. Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P 0H6. Telephone (403) 237-3737.

ITEM #27 - MINUK OFFSHORE GAS DISCOVERY

- Owner - Esso et al.
- Discovery well - Minuk I-53.
- Estimated reserves $< 2.8 \times 10^9$ m^3 natural gas.
- This relatively small offshore reserve is thought unlikely to be part of gas development in the near to mid-term. When development of the reserve is undertaken, a production facility similar to that described for Kadluk would likely be involved.
- For further details contact Mr. B. Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P 0H6. Telephone (403) 237-3737.

ITEM #28 - NEKTORALIK OFFSHORE OIL DISCOVERY

- Owner - Amoco et al.
- Discovery well - Nektoralik K-59.

- Drilling completed to date is considered insufficient to establish reserve size.

- Plans for production of oil from the Nektoralik discovery have not been made. Water at the site is greater than 50 m and as a consequence, the likely method of development that might eventually be used will likely involve a sub-sea system. Production facilities, construction and operation at Nektoralik would likely take the general form described for Adlartok (see Item #2).

- For further information contact Mr. R. Hoos, Amoco Canada Petroleum Company Ltd., Box 200, Station M, Calgary, Alberta T2P 2H8. Telephone (403) 231-6959.

ITEM #29 - NETSERK OFFSHORE GAS DISCOVERY

- Owner - Esso Resources Canada Limited.

- Discovery well - Netserk F-40.

- Estimated reserves $> 2.8 \times 10^9$ m^3 but $< 28.2 \times 10^9$ m^3 natural gas.

- Production will likely involve a caisson retained structure or some other form of artificial island from which at least four production wells will be directionally drilled. A simple gas processing facility to remove water from produced gas will also be required. Current development scenarios suggest production at Netserk will be part of a second phase of gas development in the region.

- Land (sea-bottom) required for production facilities will amount to approximately 20 ha in the immediate vicinity of the discovery well site.

- Construction of the production facility will likely be during the open-water period and will be supported primarily by marine vessels. Crews and perishables will be moved by helicopter.

- Operations at the site will involve the production, conditioning and compression of gas for transport via pipeline to an onshore gas processing plant. A permanent operations staff is anticipated.

- Operational life of the facility will likely be less than 15 years.

- During the operational period, the Netserk production facility will be supported by marine vessels and barges during open-water periods and by helicopters during all seasons.

- After depletion of gas reserves production equipment and the supporting structure will be removed.

- Plans outlined here are preliminary and have not been formally documented or subjected to detailed study.

- For further information or details contact Mr. B. Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P OH6. Telephone (403) 237-3737.

ITEM #30 - NERLERK OFFSHORE OIL AND GAS DISCOVERY

- Owner - Amoco et al.

- Discovery well - Nerlerk M-98.

- Drilling completed to date is considered insufficient to establish reserve size.

- Plans for production at the Nerlerk discovery site have not been made. Water at the site is near the current limit for bottom founded production structures, so either a sub-sea system or a bottom founded support structure could conceivably be used. Activity associated with construction and production activity at Nerlerk would likely be similar to that described for the Adlartok discovery site (see Item #2).

- For further information contact Mr. R. Hoos, Amoco Canada Petroleum Company Ltd., Box 200, Station M, Calgary, Alberta T2P 2H8. Telephone (403) 231-6959.

ITEM #31 - NIGLINTGAK ONSHORE OIL AND GAS DISCOVERY

- Owner - Shell Canada Limited and Chevron Canada Resources.

- Discovery well - Niglintgak H-30.

- Estimated reserves $> 1.5 \times 10^6$ m^3 but $< 3.0 \times 10^6$ m^3 oil, and approximately 28×10^9 m^3 natural gas.

- Gas reserves at Niglintgak will be developed during the first phase of gas development in the region but oil at the site will likely be produced during the second phase of oil development.

- Production facilities for gas will include 10 well sites; a gathering system to move raw gas from wellhead to gas plant; a processing plant and a trunkline to move processed gas to a mainline transmission pipeline.

- Production facilities for oil would consist of additional well sites, a separate gathering system and a central treating plant. A water treatment plant would be required if enhanced recovery were required.

- An area of approximately 800 ha would be involved in the general development but directly affected land would be approximately 60 ha. If oil were also developed, the general area affected would not change but the amount of directly affected land would increase slightly to accommodate additional wells and facilities.

- Production facilities would be constructed in winter. Wells for gas development would be drilled during the last two years of construction. A schedule for construction related to oil development has not been considered.

- Operational activity at the site would include regular well inspections and infrequent well "workovers". A permanent staff would live at the site and be rotated twice each month.

- Production at Niglintgak is expected to extend beyond 20 years.

- When the reservoir is depleted, surface facilities will be dismantled and the ground reclaimed to its original condition. Sub-surface lines will be abandoned in place and wells plugged.

- Additional study to define the scale, location and nature of facilities is required. Additional details on the gas facilities planned for Niglintgak are contained in Shell's 1988 export application to the National Energy Board.

- For further information contact A.B. Anderson, Senior Staff Petroleum Engineer, Oil and Gas Business Development, Shell Canada Limited, 400-4th Avenue S.W., Calgary, Alberta T2P 2H5. Telephone (403) 232-3257.

ITEM #32 - NIPTERK OFFSHORE OIL AND GAS DISCOVERY

- Owner - Esso et al.

- Discovery well - Nipterk L-19.

- Estimated reserves $> 1.6 \times 10^6$ m^3 but $< 4.0 \times 10^6$ m^3 oil, and
  $< 2.8 \times 10^9$ m^3 natural gas.

- The current low reserve estimate for gas at Nipterk suggests this discovery will not likely by included in the initial phases of gas development in the region. When gas reserves at Nipterk are developed, production facilities similar to those described for the Netserk gas discovery will likely be put in place (see Item #29) although unlike Netserk, more than one production structure might

be required. Gas reserves at Nipterk may be developed at an earlier stage if oil, which is found with gas, is produced. Oil reserves at Nipterk seem likely to be developed during the second phase of oil development in the region.

- Oil production facilities would likely be placed on an artificial island built over a period of one to two years. Construction would be supported by marine vessels during periods of open-water and by helicopters during all seasons.

- Operational activities will include drilling and servicing of production wells, storage of quantities of produced oil and pumping of oil into a pipeline for delivery to an onshore pipeline terminal.

- Operational life of the facility is expected to be 15 - 20 years.

- Plans outlined here are preliminary and have not been formally documented or subjected to detailed study.

- For further information or details contact Mr. B. Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P 0H6. Telephone (403) 237-3737.

ITEM #33 - PARSONS LAKE ONSHORE GAS DISCOVERY

- Owner - Gulf Canada Resources Limited and Mobil Oil Canada.

- Discovery well - Parsons F-09.

- The Parsons and associated Siku gas discoveries contain significant gas reserves and will be involved in the initial phase of gas development in the planning region.

- Possible development at the Parsons/Siku field could take two forms. The most likely form would involve production and processing of gas on-site and a connecting pipeline to a mainline gas transmission line routed along the Mackenzie River to the west of the field. An alternate approach could involve production and minor processing of gas (de-watering) at the field and transport of raw gas to an "industry gas plant" located along the east channel of the Mackenzie River.

- In the case of production and processing at the discovery site, facilities put in place would likely include: a staging and dock area (8 ha) on nearby Hans Bay, an airstrip and helicopter pad (6 ha), two well pads (2 ha/each), a gas processing plant (20 ha) and 34 km of all-weather permanent road connecting staging, production and processing sites. Gravel for the various facilities would be

taken from an 80 ha borrow pit. A total of 15 production wells will likely be drilled from the two production pads. Twenty-five kilometres of 250 - 500 mm diameter, elevated gathering lines would transport raw gas from production pads to the processing plant. Water removed from produced gas would be injected into disposal wells drilled for that purpose. A 600 mm diameter connecting pipeline would transport processed gas approximately 24 km to the main transmission line.

- If gas were not processed on-site, the above facilities, with the exception of a processing plant, would be required. A 600 mm diameter pipeline would carry raw gas west to an industry gas plant that might be located on the Mackenzie River's East Channel.

- Construction at the Parsons field will be supported by barge transport during open-water periods and by snow and ice roads during winter, if or when required. Both fixed-wing and rotary-wing aircraft will support operations during all seasons.

- Operational activity will involve drilling and servicing production wells and processing gas. A permanent staff of 50 persons will operate the facility.

- Support during operation will be similar to that used during construction and would likely include barge traffic in summer and possibly ground-based vehicles over snow and ice roads in winter. Aircraft will support activity during all seasons.

- Operational life of the facility is expected to be more than 20 years.

- The plans outlined above are preliminary, but are based on detailed studies completed some time ago. Currently, additional study and planning is underway to support Gulf's application to the National Energy Board for a permit to export gas from the Parsons field. It is expected that substantial changes in approach may result when plans are fully updated.

- For further details contact Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

ITEM #34 - PELLY ONSHORE GAS DISCOVERY

- Owner - Suncor Inc. et al.

- Discovery well - Sun BVX et al Pelly B-35.

- Estimated reserves $< 2.8 \times 10^9$ m^3 natural gas.

- There are at present no plans for producing gas from this relatively small offshore discovery.
- When the site is developed at some time in the future, the approach to production might be similar to that described for the nearby Adgo discovery sites (see Item #1).
- For further information contact Mr. George Eynon, Suncor Inc., 500-4th Avenue S.W., Calgary, Alberta T2P 2V5. Telephone (403) 269-8638.

ITEM #35 - PITSUILAK OFFSHORE OIL DISCOVERY

- Owner - Gulf et al.
- Discovery well - Pitsuilak A-05.
- Oil reserves at Pitsuilak are described as moderate.
- Development of the Pitsuilak oil discovery will follow development at Amauligak by a number of years and will likely involve a single production platform (caisson retained island or monolithic structure on a berm) from which a number of production wells would be directionally drilled.
- Land (sea-bottom) directly affected by the production facility would likely be no greater than 20 ha.
- Construction and operational activities at Pitsiulak will likely be similar in most respects to those described for Amauligak (see Item #3). Operational life of production facilities at Pitsiulak is also expected to be similar to that described for Amauligak.
- Gas is not present at Pitsuilak.
- Plans outlined are preliminary.
- For further details contact Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

ITEM #36 - REINDEER ONSHORE GAS DISCOVERY

- Owner - Gulf et al.
- Discovery well - Reindeer F-36.
- This very small gas discovery is not likely to be included in the initial phases of gas development in the region.

- When the Reindeer discovery is developed, production facilities, construction methods and support activity is likely to be similar to that described for the YaYa discovery sites.

- For further information contact Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

ITEM #37 - SIKU ONSHORE GAS DISCOVERY

- Owner - Gulf Canada Resources Limited and Mobil Oil Canada Ltd.

- Discovery well - Siku C-55.

- Development of the Siku gas discovery is planned to coincide with that of the larger and closely associated Parsons gas field (see Item # 33).

- For further information contact Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

ITEM #38 - TAGLU ONSHORE GAS DISCOVERY

- Owner - Esso Resources Canada Limited.

- Discovery well - Taglu G-33.

- Estimated reserves > 56.4×10^9 m^3 natural gas.

- Production at Taglu will be part of the initial phase of gas development in the region and will likely involve one or two production centres (pads) from which at least 24 production wells will be directionally drilled. In addition, a complete gas processing facility, including the supporting infrastructure (dock, airstrip, living quarters and roads between facilities) may be put in place. The total area involved, if processing facilities are installed, is estimated to be approximately 1,000 ha. Land directly affected by the placement of structures will be much less (see Appendix 3).

- Construction of production and processing facilities will likely take place over a three-year period. Major components and construction materials will be taken to the site by barge during open-water periods, or in winter will be moved by trucks over ice roads. Personnel and minor consumables will be moved by fixed-wing aircraft or helicopter throughout construction and operation.

- Operational activity will involve producing conditioning and compressing gas. Drilling activity will be continuous during the first several years of development with a rig drilling new production wells and later servicing existing wells. A permanent on-site staff of 30 - 50 persons is anticipated.

- Produced gas will likely be processed to sales gas standards on site, although an alternate approach could involve sending produced gas to an "industry" processing facility located elsewhere (possibly at Swimming Point) (see Item #47). If gas is processed on site, water removed from the raw gas would be injected into the disposal well, liquid hydrocarbons (condensate) would be removed and injected into a condensate pipeline, and treated gas would be compressed for transport in a gas transmission pipeline. If raw gas was sent to an industry plant, activity at Taglu would be limited to production drilling, possibly minor processing (de-watering) and compression of gas for transport through a gathering line.

- Operational life of production/processing facilities at Taglu is expected to be > 20 years.

- During operations, Taglu facilities would be supported by barge transport during open-water periods and by ground-based vehicles over ice roads in winter; helicopter and fixed-wing aircraft support would be utilized during all seasons.

- Upon reservoir depletion, production wells at Taglu will be abandoned and wellheads will be removed. Processing facilities will likely be used to process gas from other reserves after the Taglu field is exhausted. As a result the plant may remain in place for an extended period.

- Plans outlined here have been the subject of specific study but are preliminary in nature.

- For further details contact Mr. B. Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P 0H6. Telephone (403) 237-3737.

ITEM #39 - TARSIUT OFFSHORE OIL AND GAS DISCOVERY

- Owner - Gulf Canada Resources Limited and Amoco Canada Petroleum Company Ltd.

- Discovery well - Tarsiut A-25.

- Oil and gas reserves at the Tarsiut discovery site are described by the owners as "moderate".

- Development of the Tarsiut reserve would likely take place during the second phase of oil development in the planning region.

- Water at the site is less than 50 m making the use of a bottom founded structure to support production likely. Development could involve a single central platform such as Gulf's existing Molipaq caisson (see Appendix 3). A berm occupying approximately 20 ha of sea bottom would be created and the caisson sections would be placed upon it.

- The production support structure would likely be constructed during the open-water period. Construction would take several years and would be supported by marine vessels and helicopters.

- Operational activity at the site would initially involve production drilling, oil production, minor treatment (de-watering) and storage of oil. Produced oil would be pumped to an onshore pipeline terminal in a sub-sea pipeline. Alternately, produced oil might be shipped by tanker if an onshore oil pipeline was not available.

- Operational life of production facilities at the Tarsiut site might extend over a period of 15 - 20 years.

- Upon reservoir depletion, sub-sea production equipment would be abandoned but the bottom founded support structure would likely be re-mobilized for use elsewhere.

- Plans outlined here are tentative and are not based on formal detailed study.

- Further information may be obtained from Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

ITEM #40 - TINGMIARK OFFSHORE GAS DISCOVERY

- Owner - Amoco et al.

- Discovery well - Tingmiark K-91.

- Information obtained from drilling so far completed is considered insufficient to estimate reserve size.

- Plans for production of gas at the Tingmiark site have not been made.

- For further information contact Mr. R. Hoos, Amoco Canada Petroleum Company Ltd., Box 200, Station M, Calgary, Alberta T2P 2H8. Telephone (403) 231-6959.

ITEM #41 - TITALIK ONSHORE GAS DISCOVERY

- Owner - Esso et al.
- Discovery well - Titalik K-26
- Estimated reserves $< 2.8 \times 10^9$ m^3 natural gas.
- This small onshore gas reserve would not likely be included in the first or second phases of gas development in the region. When developed, production facilities would likely be similar to those described for Hansen or Mallik (see Items #9 and #25).
- For further details contact Mr. B. Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P OH6. Telephone (403) 237-3737.

ITEM #42 - TUK CRETACEOUS ONSHORE GAS DISCOVERY

- Owner - Esso Resources Canada Limited.
- Discovery well - Tuk G-39.
- Estimated reserves $> 2.8 \times 10^9$ m^3 but $< 28.2 \times 10^9$ m^3 natural gas.
- Production is likely to involve a well pad from which at least 4 production wells will be directionally drilled. The pad will probably also support a simple gas processing facility. Production of gas from the Tuk site will likely occur as part of a second phase of gas development in the region.
- Land required for the production facilities will be 20 - 30 ha in the immediate vicinity of the discovery well.
- Construction of production facilities will likely extend over a two-year period. Major components and most construction materials would be moved from Tuktoyaktuk by ground-based vehicles over winter and ice roads, or possibly via a permanent road.
- Operational activity will involve producing, conditioning and compressing gas for transport to a processing plant via a pipeline. A small permanent operations staff may be required.
- Produced gas will be de-watered and injected into a gathering line.
- Operational life of the facility is expected to be less than 15 years.

- During operations, the facility will be supported from Tuktoyaktuk using ice roads in winter, or alternatively, over a permanent road, if the latter is available. Helicopters will likely be used for moving personnel during all seasons.

- When the reservoir is depleted production facilities will be removed.

- The plans outlined above are preliminary and have not been formally documented or subjected to detailed study.

- For further information contact Mr. B. Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P OH6. Telephone (403) 237-3737.

ITEM #43 - TUK TERTIARY ONSHORE OIL DISCOVERY

- Owner - Esso et al.

- Discovery well - Tuk M-09.

- Estimated reserves > 4.0×10^6 m^3 oil.

- Production of oil from the Tuk Tertiary discovery will likely occur during the second phase of oil development in the planning region. Facilities to produce the oil will include a relatively large number of small gravel drilling pads which in total may directly involve 250 ha of land.

- Construction of production facilities will likely extend over a number of years and will involve movement of materials and equipment to the site from Tuktoyaktuk over winter ice and snow roads, or possibly along a permanent all-weather road, should the latter be available.

- Operational activity will include drilling of production wells, oil production, well servicing and minor processing of the produced oil (de-watering and de-gassing). Produced oil will likely be stored for a time prior to being transported by pipeline.

- Production of the Tuk Tertiary discovery may continue for 15 - 20 years.

- For further information or details contact Mr. Brian Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P OH6. Telephone (403) 237-3737.

ITEM #44 - UKALERK OFFSHORE GAS DISCOVERY

- Owner - Amoco et al.
- Discovery well - Ukalerk C-50.
- Drilling information which is presently available is considered insufficient to support reserve estimates.
- Plans for production of gas at the Ukalerk discovery site have not been made.
- For further information contact Mr. R. Hoos, Amoco Canada Petroleum Company Ltd., Box 200, Station M, Calgary, Alberta T2P 2H8. Telephone (403) 231-6959.

ITEM #45 - WEST ATKINSON OFFSHORE OIL DISCOVERY

- Owner - Esso Resources Canada Limited.
- Discovery well - West Atkinson L-17.
- Estimated reserves $> 1.6 \times 10^6$ m^3 but $< 4.0 \times 10^6$ m^3 oil.
- Production at the West Atkinson location would involve an artificial island constructed at or near the discovery site. Multiple production wells would be directionally drilled from the island. Produced oil would be de-watered and transported to shore by pipeline. Oil from the West Atkinson site will likely be produced as part of a second phase of oil development in the region and would be closely associated with production activities at the nearby onshore Atkinson oil discovery.
- Land (sea-bottom) directly affected by production facilities would total approximately 20 ha. Construction timing, support and operational activity at West Atkinson would likely be similar to that described for the Adgo field (see Item #1).
- Plans outlined here are preliminary and have not been formally documented or subjected to detailed study.
- For further information or details contact Mr. B. Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P OH6. Telephone (403) 237-3737.

ITEM #46 - YAYA ONSHORE GAS DISCOVERY

- Owner - Gulf Canada Resources Limited and Mobil Oil Canada.

- Discovery wells - YaYa A-28 and YaYa P-53.

- The YaYa discovery contains moderate gas reserves.

- Production of YaYa gas reserves may take place during the second phase of gas development in the region and will likely involve two production drilling pads (2 ha each), at which only two production wells will be drilled. A 64 km long elevated pipeline (200 - 300 mm diameter) may be installed to carry raw gas to Parsons Lake for processing. Alternately, gas from YaYa could be piped to an "industry gas plant" along the east channel of the Mackenzie River, or to gas processing facilities at Taglu on Richards Island. It is likely that production would be remotely controlled and that no permanent staff would be on-site during operations.

- Construction at the YaYa discovery sites would be supported by barge transport to a nearby staging area (possibly Tununuk Point or Swimming Point) and ground vehicles travelling over winter snow and ice roads. Similar support would be used during operation. Helicopters would be used to move men and perishables during all seasons.

- Operational life of production facilities at the YaYa field is expected to be 10 years.

- Production facilities would be removed when the reservoir became depleted.

- Plans outlined here are preliminary and are not based on detailed study.

- For further details contact Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

ITEM #47 - SWIMMING POINT AREA

- The previously used staging area at Swimming Point is a possible site for an "industry gas plant" which would process gas from throughout the Mackenzie Delta region. Such an approach to gas processing is an alternate to plans that involve processing gas at plants located over the three major gas reservoirs at Taglu, Niglintgak and Parsons Lake. There are no gas reserves located in the immediate vicinity of Swimming Point.

- Processing facilities at or near Swimming Point would likely be laid out over an area encompassing approximately 500 ha. A dock, an airstrip and accommodations for staff would be developed. An airstrip currently exists at the site.

- Construction of a processing plant at Swimming Point would probably take three years and would involve support from river barges, and possibly ocean barges, during periods of open-water. Ground-based vehicles travelling over ice roads would be used in winter.

- Unlike facilities proposed for the Taglu, Niglintgak and Parsons Lake gas fields, operations at Swimming Point would involve gas processing only. Production drilling would not be part of operational activities at the site. It is expected that gas processing at Swimming Point would require a permanent staff of 30 - 50 persons. Raw gas arriving at Swimming Point would be processed to sales gas quality for injection into a high-pressure transmission line. Condensate would be injected into a separate pipeline and water removed by processing would be injected into disposal wells drilled for that purpose.

- Operational life of the facility would be more than 20 years.

- While operating, the facility would be supported by river barges in summer and by ground-based vehicles travelling over winter ice roads. Helicopter and fixed-wing aircraft would be used to move personnel and minor consumables during all seasons.

- Upon completion of its useful life the facility would be removed.

- Plans for gas processing at Swimming Point are preliminary in the extreme. No specific engineering consideration has been given to the overall feasibility of the approach or to site-specific constraints.

- Swimming Point will likely be used as a staging area and base camp for development in the region, even if it is not used as a site for gas processing (see Item #A1).

- For further details contact Mr. B. Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P 0H6. Telephone (403) 237-3737.

TRANSPORT CORRIDORS

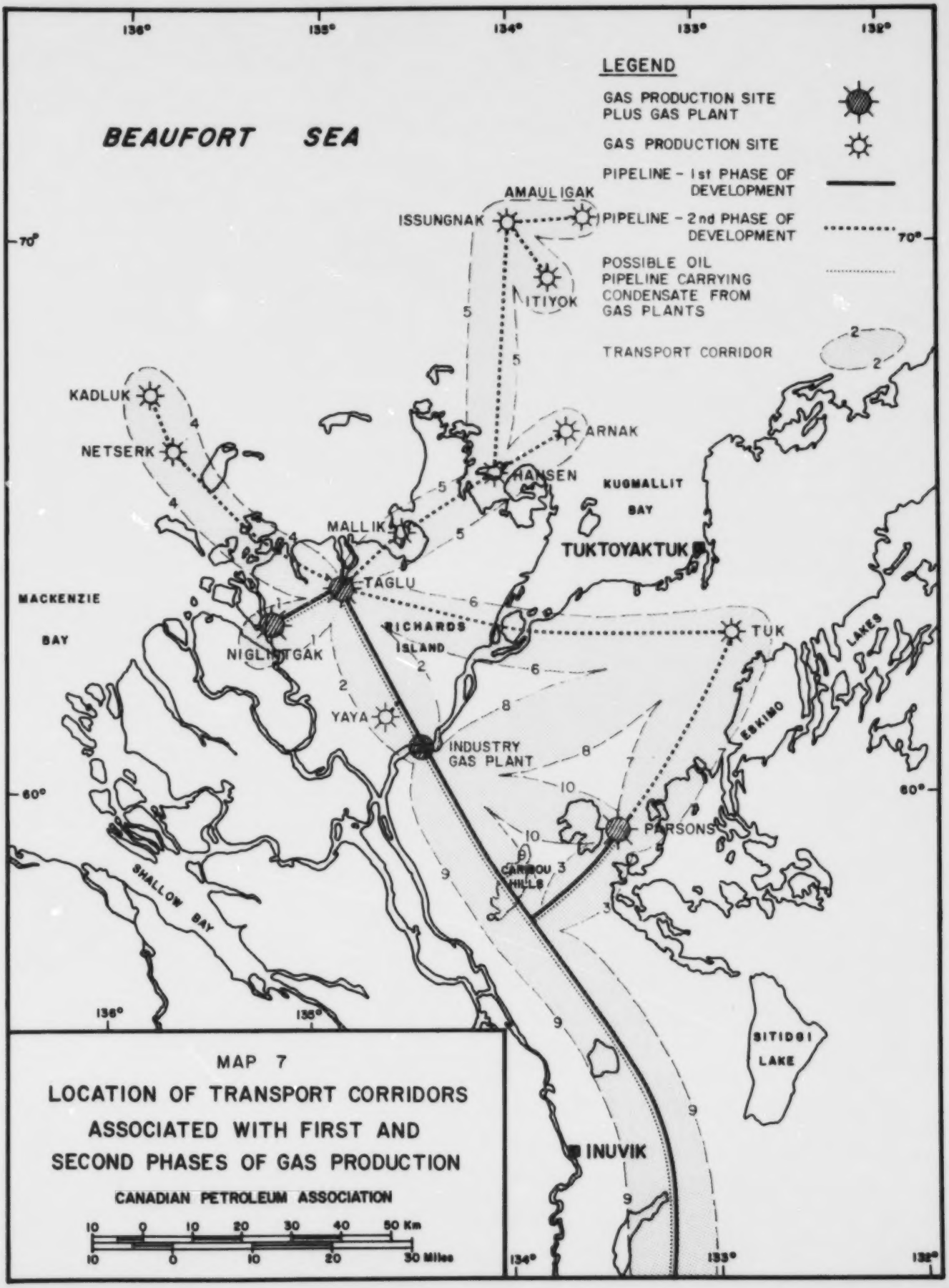
Oil and gas development that might occur in the Mackenzie Delta and southern Beaufort Sea region, as defined by the three development scenarios described in the CPA's previous report, could involve 23 separate production sites during the initial stages of development and require connecting pipelines along 17 different pathways. Those production sites and transport

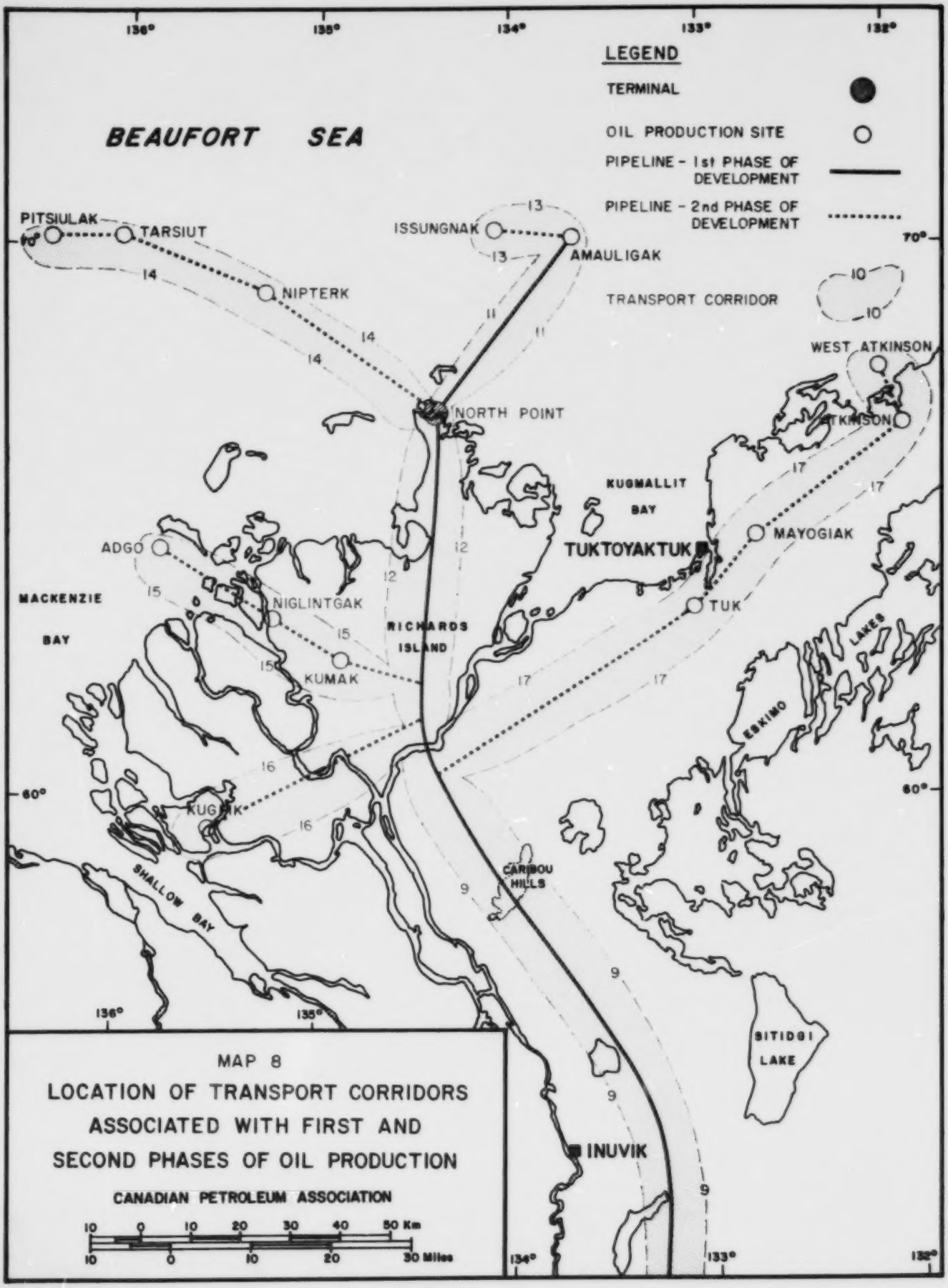
pathways are shown schematically by **Maps** 4 and 5 for gas development and **Map** 6 for oil development. The transport pathways could, depending upon the nature and sequence of developments, contain several different combinations of pipeline facilities.

With few exceptions, specific routes for the pipelines defined by the development scenarios have not been chosen. Since from a pipeline routing standpoint much of the region is characterized by difficult terrain, the pipeline routes that are eventually chosen may not closely follow the relatively direct routes indicated by the schematic map.

To better define the possible divergence of finally selected pipeline routes from the straight line "ideal" shown by **Maps** 4 to 6, transport pathways might be better viewed as corridors. **Maps** 7 and 8 illustrate corridors associated with gas and oil development respectively. The following descriptive sections have been prepared for the 17 pathways/corridors in which pipeline facilities will likely be located within the planning region. The anticipated outer limit of pipeline routing through each corridor is indicated by the corridor's boundary drawn in an approximate fashion on **Maps** 7 and 8 and much more accurately on 1:250,000 scale topographic maps submitted separately to the Commission. It should be noted that the amount of land that will actually be used for petroleum transport within each corridor area will likely consist of one or possibly several rights-of-way ranging in width from 30 to 50 metres, and will represent a small fraction of the land within the corridor's boundaries.

Numbers assigned to corridors in the following text sections match those used to identify corridor boundaries on the separately submitted 1:250,000 scale maps and also match the numbers on the schematic corridors shown by **Maps** 7 and 8.


136°
135°
134°
133°
132°
70°
60°
BEAUFORT SEA
LEGEND
GAS PRODUCTION SITE PLUS GAS PLANT
GAS PRODUCTION SITE
PIPELINE - 1st PHASE OF DEVELOPMENT
PIPELINE - 2nd PHASE OF DEVELOPMENT
POSSIBLE OIL PIPELINE CARRYING CONDENSATE FROM GAS PLANTS
TRANSPORT CORRIDOR
AMAULIGAK
ISSUNGNAK
ITIYOK
KADLUK
NETSERK
ARNAK
HANSEN
KUGMALLIT BAY
MALLIK
TUKTOYAKTUK
TAGLU
MACKENZIE BAY
RICHARDS ISLAND
NIGLINTGAK
TUK
LAKES
YAYA
ESKIMO
INDUSTRY GAS PLANT
PARSONS
CARIBOU HILLS
SHALLOW BAY
SITIDGI LAKE
INUVIK
MAP 7
LOCATION OF TRANSPORT CORRIDORS ASSOCIATED WITH FIRST AND SECOND PHASES OF GAS PRODUCTION
CANADIAN PETROLEUM ASSOCIATION
10 0 10 20 30 40 50 Km
10 0 10 20 30 Miles



MAP 8

LOCATION OF TRANSPORT CORRIDORS ASSOCIATED WITH FIRST AND SECOND PHASES OF OIL PRODUCTION

CANADIAN PETROLEUM ASSOCIATION

10 0 10 20 30 40 50 Km

10 0 10 20 30 Miles

CORRIDOR #C1 - NIGLINTGAK TO TAGLU

- In the case of a three gas plant scenario this corridor would be used to move processed gas and liquid hydrocarbon condensates from processing facilities at Niglintgak. If an "industry plant" scenario were to be followed, raw gas would be moved along the Corridor and a separate condensate line would be unlikely. Oil at Niglintgak might be produced along with natural gas, processed on site, and shipped via the condensate pipeline put in place to service gas processing.

- Pipelines that might be placed in the Corridor for a three gas plant scenario include: a 400 mm, chilled, buried line to carry processed gas, and a 150 mm line, likely buried, to carry condensate and possibly oil. Pipe sizes and above/below grade modes have not been determined for a development approach requiring the movement of raw gas from Niglintgak (see Appendix 3).

- Land requirements for the processed gas line would involve a right-of-way (ROW) approximately 30 metres wide. Additional lines would add 10 to 20 metres to ROW requirements.

- Pipeline construction would very likely occur in winter, no matter what form of pipeline system was required.

- Once installed, pipelines will be inspected regularly, using aircraft, or ground-based vehicles in winter. Pipelines will require occasional maintenance using heavy equipment, an activity that would also occur in winter.

- Further studies to define the scale, location and scope of facilities and development timing are required.

- For further information contact A.B. Anderson, Senior Staff Petroleum Engineer, Oil and Gas Business Development, Shell Canada Limited, 400-4th Avenue S.W., P.O. Box 100, Station M, Calgary, Alberta T2P 2H5. Telephone (403) 232-3257.

CORRIDOR #C2 - TAGLU TO SWIMMING POINT

- The Taglu to Swimming Point Corridor would be used for transporting processed gas and condensate from Taglu to Swimming Point in the case of a "three gas plant" development scenario. The Corridor might also contain gathering lines from fields located in southern portions of Richards Island, such as YaYa, if a three plant approach were used. If an "industry plant" scenario were to develop, the Corridor would contain a pipeline for transporting raw gas from Taglu to an industry gas plant presumed to be at Swimming Point. In this latter case, raw gas gathering lines from smaller Richards Island fields might also be routed along the corridor.

- Possible pipeline and related facilities in the Corridor include:

  1) for a three plant scenario:

     - a 750 - 950 mm diameter processed gas line,

     - a 250 - 950 mm diameter condensate line; and

     - one or more small diameter raw gas gathering lines.

  2) for an industry plant scenario:

     - a 750 - 950 mm diameter raw gas line,

     - one or more small diameter raw gas gathering lines; and

     - a power line to Taglu from the industry plant.

- A decision on the mode of pipeline placement in the Taglu to Swimming Point Corridor (buried versus elevated) has not yet been reached (see Appendix 3).

- Corridor boundaries mapped at 1:250,000 scale reflect uncertainty in the location of condensate and raw gas lines. Should a three plant scenario develop the 750 - 950 mm processed gas line would likely follow the route selected by Polar Gas and/or Foothills Pipe Lines (Yukon) Ltd. Routes chosen by those firms are shown on the 1:250,000 scale maps supplied to the Commission. Also, should the three plant scenario develop, the processed gas line would likely be buried, as it is the intention of both pipeline proponents to place pipe in a conventional buried mode.

- Plans outlined here are preliminary but pipeline routes proposed by Foothills Pipe Lines (Yukon) Ltd. and Polar Gas have been given careful examination and are likely near the ideal location.

- For further information contact:

  Mr. Ken Sortland, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P 0H6. Telephone (403) 237-3737.

  Mr. Dan Begley, Foothills Pipe Lines (Yukon) Ltd., #3000, 707-Eighth Avenue S.W., Calgary, Alberta T2P 3W8. Telephone (403) 294-4111.

  Mr. Ollie Kaustinen, Polar Gas Project, P.O. Box 90, Commerce Court West, Toronto, Ontario N5L 1H3. Telephone (416) 869-2619.

CORRIDOR #C3 - PARSONS TO THE PARSONS/MAINLINE JUNCTION

- This Corridor would carry processed gas and condensate from a Parsons Lake gas processing plant to a mainline gas pipeline routed along the East Channel of the Mackenzie River. The Corridor would be used only in the case of a "three plant" development scenario.

- Possible pipeline facilities in the Corridor include:

  - a 600 mm diameter buried pipeline to carry processed gas, and

  - a 200 mm diameter buried pipeline to carry condensate.

- Plans outlined here are preliminary but have been the subject of detailed study.

- For further information contact Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

CORRIDOR #C4 - KADLUK TO TAGLU

- This Corridor would be used to transport raw gas from offshore reserves at the Netserk and Kadluk discovery sites to processing facilities at Taglu. The configuration and use of the Corridor would remain unchanged for either a "three plant" or an "industry" development scenario.

- Pipeline facilities in the Corridor would consist of a 400 - 600 mm raw gas pipeline that would likely be buried along offshore sections. Onshore mode (buried/elevated) has not been determined.

- Plans indicated are preliminary.

- For further details contact Mr. Ken Sortland, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P 0H6. Telephone (403) 237-3737.

CORRIDOR #C5 - AMAULIGAK TO TAGLU

- The Amauligak to Taglu Corridor would be used to transport raw gas from offshore discoveries at Amauligak, Issungnak, Itiyok and Hansen, together with gas produced at onshore reserves located at Hansen and Mallik, to gas processing facilities at Taglu. The configuration and use of the Corridor would remain unchanged for either the "three plant" or "industry" development scenarios.

- Pipeline facilities in the Corridor would include both sub-sea and terrestrial pipelines carrying raw gas. Sub-sea lines would be buried, but terrestrial lines could be buried or elevated, depending upon future design decisions. The diameter of the pipelines would vary along the Corridor as additional gas from the several production sites was added. In the section approaching the Taglu plant the pipe is expected to be 500 - 750 mm in diameter.

- Plans described here are preliminary.

- For further information contact Mr. Ken Sortland, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P 0H6. Telephone (403) 237-3737.

CORRIDOR #C6 - TUK TO TAGLU

- This Corridor would carry raw gas and possibly liquid hydrocarbons produced at wells on the Tuktoyaktuk Peninsula to Taglu for processing, if a "three gas plant" scenario were adopted. The Corridor would not be used for other development scenarios. An alternate to processing Tuk gas at Taglu would be to transport it to processing facilities at Parsons Lake (see Corridor #C7). The liquid hydrocarbons involved would be oil and condensates produced along with the gas or oil produced at closely associated oil discoveries. The oil would be injected into the condensate pipeline carrying liquid by-products from gas processing at Taglu or at Parsons Lake.

- Possible pipeline facilities in the Corridor include:

  - a 300 - 500 mm diameter raw gas line, and

  - a 250 - 400 mm diameter liquids line.

- Designs for pipelines in the region, particularly terrestrial gathering lines, are not well developed and a decision on whether or not to bury these lines has not yet been reached.

- Plans outlined are preliminary.

- For further information contact Mr. Ken Sortland, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P 0H6. Telephone (403) 237-3737.

CORRIDOR #C7 - TUK TO PARSONS

- This Corridor would be used to transport raw gas and possibly liquid hydrocarbons from wells on the Tuktoyaktuk Peninsula to gas processing facilities at Parsons Lake and would be used only in the case of a "three gas plant" development scenario. An alternate

to processing Tuk gas at Parsons Lake would be to transport it to Taglu (see Corridor #C6).

- Possible pipeline facilities in the corridor include:

  - a 300 - 500 mm diameter raw gas line; and

  - a 250 - 400 mm diameter liquids line.

- Designs for pipelines in the region, particularly gathering lines, are incomplete and a decision on whether or not to bury pipelines has not yet been reached.

- Plans outlined here are preliminary.

- For further information contact Mr. Ken Sortland, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P 0H6. Telephone (403) 237-3737.

CORRIDOR #C8 - TUK TO SWIMMING POINT

- This Corridor would be used to transport raw gas produced at wells on the Tuktoyaktuk Peninsula to gas processing facilities located at an industry gas plant along the East Channel of the Mackenzie River, presumed to be at Swimming Point. The Corridor would be used only in the case of an "industry" gas development scenario. This Corridor might also be used to transport oil produced on the Tuktoyaktuk Peninsula to gas processing facilities for injection into a condensate pipeline.

- Pipeline facilities in the Corridor might include:

  - a 300 - 500 mm diameter raw gas line; and

  - a 250 - 400 mm diameter liquids line.

- Plans described here are preliminary.

- As mentioned in previous sections, it is not clear whether terrestrial pipelines in this region will be buried or elevated.

- For further information contact Mr. Ken Sortland, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P 0H6. Telephone (403) 237-3737.

CORRIDOR #C9 - SWIMMING POINT TO CAMPBELL HILLS, SOUTH

- This Corridor contains the mainline southbound portions of gas, oil and condensate lines, and would be utilized for at least one

of these no matter what development scenario occurs. The Corridor, as mapped at 1:250,000 scale, is centered on the gas pipeline routes chosen by Foothills Pipe Lines (Yukon) Ltd. and Polar Gas. The width of the Corridor illustrated reflects uncertainty over the location of the condensate and oil pipelines which, depending upon designs chosen, may not require terrain exactly similar to that chosen as best for the natural gas pipelines.

- Possible pipeline facilities in the Corridor include:

  - an 800 - 900 mm diameter buried, chilled natural gas pipeline;

  - a 500 - 600 mm diameter oil pipeline; and

  - a 250 - 400 mm diameter condensate line.

- Plans outlined here are preliminary.

- For further information contact:

  Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

  Mr. Dan Begley, Foothills Pipe Lines (Yukon) Ltd., #3000, 707-Eighth Avenue S.W., Calgary, Alberta T2P 3W8. Telephone (403) 294-4111.

  Mr. Ollie Kaustinen, Polar Gas Project, P.O. Box 90, Commerce Court West, Toronto, Ontario N5L 1H3. Telephone (416) 869-2619.

CORRIDOR #C10 - PARSONS TO SWIMMING POINT

- In the case of an industry plant development scenario, a corridor in which raw gas from the Parson Lake area could be transported to the industry plant (presumed to be at Swimming Point) would be required. Like the Niglintgak to Taglu Corridor and several of the corridors linking gas discoveries on the Tuktoyaktuk Peninsula to gas processing plants, this Corridor could also contain a small liquids (oil) pipeline that would carry oil produced at the gas field or at nearby oil discoveries. Produced oil would be injected into the south-bound condensate pipeline at the main gas processing facility. The Corridor from Parsons to Swimming Point would not be used in the case of a three plant development approach.

- Possible pipeline facilities in the Corridor include:

  - a 750 to 950 mm raw gas pipeline; and

  - a 250 - 400 mm liquids pipeline.

- Designs for pipelines in the region, especially terrestrial gathering lines, are as yet preliminary and decisions on whether or not to bury pipelines have not yet been reached.

- Plans outlined here are preliminary.

- For further information contact Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3152.

CORRIDOR #C11 - AMAULIGAK TO NORTH POINT

- This Corridor would be used to transport oil produced at Amauligak to an oil pipeline terminal on North Point and would be used only as part of oil development.

- A 500 mm diameter sub-sea, buried pipeline, would be located in the Corridor.

- Offshore sections of the pipeline would be constructed during open-water periods using marine vessels. Shallow water sections could be constructed in winter through the sea ice.

- Plans outlined here are preliminary.

- For further information contact Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

CORRIDOR #C12 - NORTH POINT TO SWIMMING POINT

- This Corridor would be used to transport oil, produced at Amauligak and other offshore locations, from North Point on northern Richards Island to the East Channel crossing of the Mackenzie River, which is presumed to be at Swimming Point. The Corridor would be used only in the event of oil development.

- Pipeline facilities in the Corridor would consist of a single 500 mm diameter buried oil pipeline.

- A pump station would be included with other facilities put in place at North Point.

- Plans for this Corridor are preliminary.

- For further information contact Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

CORRIDOR #C13 - ISSUNGNAK TO AMAULIGAK

- The second phase of oil development will involve the connection of additional offshore and onshore oil reserves to the oil pipeline constructed to initially move oil from Amauligak. This second phase of development will likely involve connecting nearby oil reserves at Issungnak to facilities established at Amauligak during the initial stages of development.

- Pipeline facilities in this Corridor could include a 200 - 400 mm diameter buried sub-sea pipeline.

- In the event both oil and gas development were to proceed, a 500 - 600 mm diameter gas line might also be placed in this Corridor to transport gas produced at Amauligak to Issungnak for eventual transport to shore-based gas processing plants (see Corridor #C5).

- Plans presented here are preliminary.

- For further information contact Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

CORRIDOR #C14 - PITSIULAK TO NORTH POINT

- During the second phase of oil development in the region, this Corridor could be used to transport oil produced at offshore discovery sites at Pitsiulak, Tarsiut and Nipterk to an oil pipeline terminal at North Point.

- Pipeline facilities in the Pitsiulak to North Point Corridor would include a single sub-sea buried oil pipeline ranging in size from 400 - 600 mm in diameter.

- Plans outlined are preliminary.

- For further information contact Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

CORRIDOR #C15 - ADGO TO NIGLINTGAK TO MAINLINE OIL PIPELINE

- A corridor from the offshore oil discoveries at Adgo, west of Garry Island, if routed south and east, could be used to transport oil from Adgo, Niglintgak and Kumak to a mainline oil pipeline traversing Richards Island from north to south.

- Pipeline facilities in an Adgo to Niglintgak to Mainline Oil Pipeline Corridor would include a 250 - 300 mm oil pipeline that

would be buried in offshore areas. Onshore portions of the pipeline might be buried or elevated, depending upon the outcome of pipeline design studies.

- Plans outlined here are preliminary.
- There have been no studies on development of Kumak oil reserves.
- For further information, contact A.B. Anderson, Senior Staff Petroleum Engineer, Oil and Gas Business Development, Shell Canada Limited, 400-4th Avenue S.W., P.O. Box 100, Station M, Calgary, Alberta T2P 2H5. Telephone (403) 232-3257.

CORRIDOR #C16 - KUGPIK TO MAINLINE OIL PIPELINE

- During the second phase of oil development in the region, a corridor to carry oil produced at the Kugpik discovery to a mainline oil pipeline will likely be required.
- Pipeline facilities in the Kugpik to Mainline Oil Pipeline Corridor would likely consist of a 150 mm oil pipeline. It is uncertain whether this pipeline would be buried or elevated.
- Plans outlined here are preliminary as there have been no studies on development of Kugpik oil reserves.
- For additional information contact A.B. Anderson, Senior Staff Petroleum Engineer, Oil and Gas Business Development, Shell Canada Limited, 400-4th Avenue S.W., P.O. Box 100, Station M, Calgary, Alberta T2P 2H5. Telephone (403) 232-3257.

CORRIDOR #C17 - WEST ATKINSON TO A JUNCTION WITH THE MAINLINE OIL PIPELINE

- This Corridor would be used to transport oil produced at the West Atkinson, Atkinson and Mayogiak discovery sites to the mainline southbound oil pipeline. Connection with the mainline pipe would be in the vicinity of Swimming Point along the East Channel of the Mackenzie River. The Corridor might also be used to transport gas, produced with the oil at the several Atkinson sites, to processing facilities along the East Channel (Swimming Point) or to Taglu.
- Pipeline facilities in the Corridor could consist of:

  - a 300 - 400 mm diameter oil pipeline; and

  - a 300 - 500 mm diameter gas pipeline.

- It is not clear at this point in time whether the pipelines in this Corridor would be buried or elevated.

- Plans outlined here are preliminary.
- For further information contact Mr. Ken Sortland, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P 0H6. Telephone (403) 237-3737.

TRANSMISSION PIPELINES

Based on the likely oil and gas development scenarios for the planning region and current pipeline proposals, three separate transmission pipelines to move petroleum may eventually be put in place. They are:

- a natural gas pipeline;
- an oil pipeline; and
- possibly a condensate pipeline.

Currently three proposals exist for construction of a pipeline that could carry natural gas from the planning region. Some time ago, Foothills Pipe Lines (Yukon) Ltd. proposed a Dempster Lateral Gas Pipeline which would move gas from the Mackenzie Delta and southern Beaufort Sea to a larger Alaska Highway Gas Pipeline in Yukon Territory. More recently, Foothills has proposed a Mackenzie Valley Pipeline that would carry gas from the Delta to join a pre-built extension of Alaska Highway Gas Pipeline facilities in northwestern Alberta. The Polar Gas Project has proposed a Polar Gas Pipeline that, in its first phase, would move gas from the Mackenzie Delta and southern Beaufort Sea along the Mackenzie River Valley. A second phase of the Polar Gas project would move gas from the planning region in the vicinity of Melville Island to join the first phase pipeline near the community of Fort Good Hope.

An oil pipeline to carry oil produced in the Mackenzie Delta and southern Beaufort Sea has been discussed for several decades. Currently there are no firm proposals for such a facility. Nevertheless, an oil line is considered an essential element in development of the region's petroleum reserves, and

an oil pipeline is expected to be in place and operating before the end of the century.

If a gas production and transport system is put in place before an oil transport system, a separate condensate pipeline would likely be constructed along with the gas pipeline. A condensate pipeline would probably connect with the Norman Wells oil pipeline south of the planning region.

The following sections briefly describe current transmission line proposals and possibilities, as well as land use likely to be associated with them. Letter identifiers used in section titles match those used to identify the several pipeline routes drawn on 1:250,000 and 1:500,000 scale maps submitted separately to the Commission.

DLP - THE DEMPSTER LATERAL GAS PIPELINE

- Foothills Pipe Lines (Yukon) Ltd. has proposed an 863 mm diameter natural gas pipeline that would carry gas from processing plants at Niglintgak, Taglu and Parsons Lake to a larger Alaska Highway Gas Pipeline in Yukon Territory. Called the Dempster Lateral Gas Pipeline because it follows the Dempster Highway, this pipeline is proposed to carry Canadian gas from the Mackenzie Delta region, if Alaskan gas reserves are moved along an Alaska Highway Gas Pipeline routed through southern Yukon. The Dempster Lateral Pipeline will not be built unless the Alaska Highway Gas Pipeline is in place.

- In the planning region, the Dempster Lateral Pipeline would be buried and would carry chilled gas. As currently proposed, construction in the area would occur in summer from a gravel pad that would be put in place the previous winter.

- An application to the National Energy Board for the Dempster Lateral Gas Pipeline has been submitted but has not been examined by the Board because of delays in the associated Alaska Highway Gas Pipeline Project.

- Plans for construction included in the application and referred to above are out of date and could change in many respects if the project were to be re-activated.

- The pipeline route shown on separate 1:250,000 scale maps was selected after detailed on-site examination. Substantial alterations are therefore not likely, but minor changes to account

for final pipeline design decisions and updated terrain studies can be expected. Route alterations to account for land use conflicts can be accommodated.

- For further information contact Mr. Dan Begley, Foothills Pipe Lines (Yukon) Ltd., #3000, 707-Eighth Avenue S.W., Calgary, Alberta T2P 3W8. Telephone (403) 294-4111.

PGP - THE POLAR GAS PIPELINE

- The Polar Gas Project group has proposed construction of a 914 mm diameter natural gas pipeline to carry gas processed at Niglintgak, Taglu and Parsons Lake south along the Mackenzie River to other pipeline facilities in Alberta.

- In the planning region, the Polar Gas Pipeline would be buried and would carry chilled gas. Construction in the region, as currently proposed, would occur in winter using conventional techniques.

- Polar Gas Project has submitted an application for the first phase of the Polar Gas Pipeline to the National Energy Board. Examination of that application by the Board has been delayed.

- A second phase of the Polar Gas Pipeline Project could involve construction of a gas pipeline from Melville Island south to carry gas reserves found in the arctic islands to phase one facilities near Fort Good Hope. Planning for this second phase is preliminary in nature.

- Selected routes for both the first and second phases of the Polar Gas Pipeline Project are shown on 1:250,000 and 1:500,000 scale maps forwarded to the Commission. The routing for the first phase of development was selected after considerable study and on-site examination. Substantial alterations in the selected first-phase routing are therefore not anticipated. Minor changes can, however, be expected as pipeline design criteria become final and updated terrain information is obtained. Change in routing to account for land use conflicts can be accommodated.

- For further information contact Mr. Ollie Kaustinen, Polar Gas Project, P.O. Box 90, Commerce Court West, Toronto, Ontario M5L 1H3. Telephone (416) 869-2619.

OP - OIL PIPELINE

- Development of oil reserves at the Amauligak discovery, as well as those found elsewhere in the planning region, will require an oil pipeline to carry produced oil south along the Mackenzie River.

- An oil pipeline would likely begin at North Point on Richards Island, traverse Richards Island to a crossing of the Mackenzie River near Swimming Point, and then closely parallel the route selected by the Polar Gas Project for a gas pipeline south through the planning region.

- An oil pipeline would likely be 500 - 600 mm in diameter and would be buried. Construction would almost certainly occur in winter and would likely extend over a two-year period. Some river crossings and pump stations would be constructed in summer.

- Detailed studies of oil pipeline design, route selection and construction planning have not been completed.

- For further information, contact Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

CP - CONDENSATE PIPELINE

- A 400 - 600 mm diameter pipeline to carry condensate south from gas processing facilities located in the Delta region may be required if a gas processing and transport system precedes an oil transport system. If an oil system is put in place first, gas condensates would be injected into the oil pipeline and transported with the oil.

- Design, route selection criteria and construction plans for a condensate line have not been studied.

- Any route chosen for a condensate pipeline would, to the greatest extent possible, closely parallel the route selected for a gas transmission line.

- For further information contact Mr. K. Sortland, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P OH6. Telephone (403) 237-3737.

MVP - MACKENZIE VALLEY PIPELINE

- Foothills Pipe Lines (Yukon) Ltd. recently announced plans to prepare an application to the National Energy Board for an 863 mm diameter gas pipeline that would carry natural gas produced and processed in the Mackenzie Delta region south to connect with an extension of pre-built sections of the Alaska Highway Gas Pipeline in Alberta. The Mackenzie Valley Pipeline would not be affected by the timing of completion of the Alaska Highway Gas Pipeline.

- In the planning region, the Mackenzie Valley Pipeline would be buried and would carry chilled gas. Construction would take place in winter.

- The proposed routing for the Mackenzie Valley Pipeline is shown on 1:250,000 scale maps submitted separately to the Commission.

- For additional information contact Mr. Dan Begley, Foothills Pipe Lines (Yukon) Ltd. #3000, 707-8th Avenue S.W., Calgary, Alberta T2P 3W8. Telephone (403) 294-4111.

SPECIAL AREAS

In addition to hydrocarbon discovery sites, where production and processing activity is likely to occur, a number of other land areas in the planning region are of particular value to the oil and gas industry. These include:

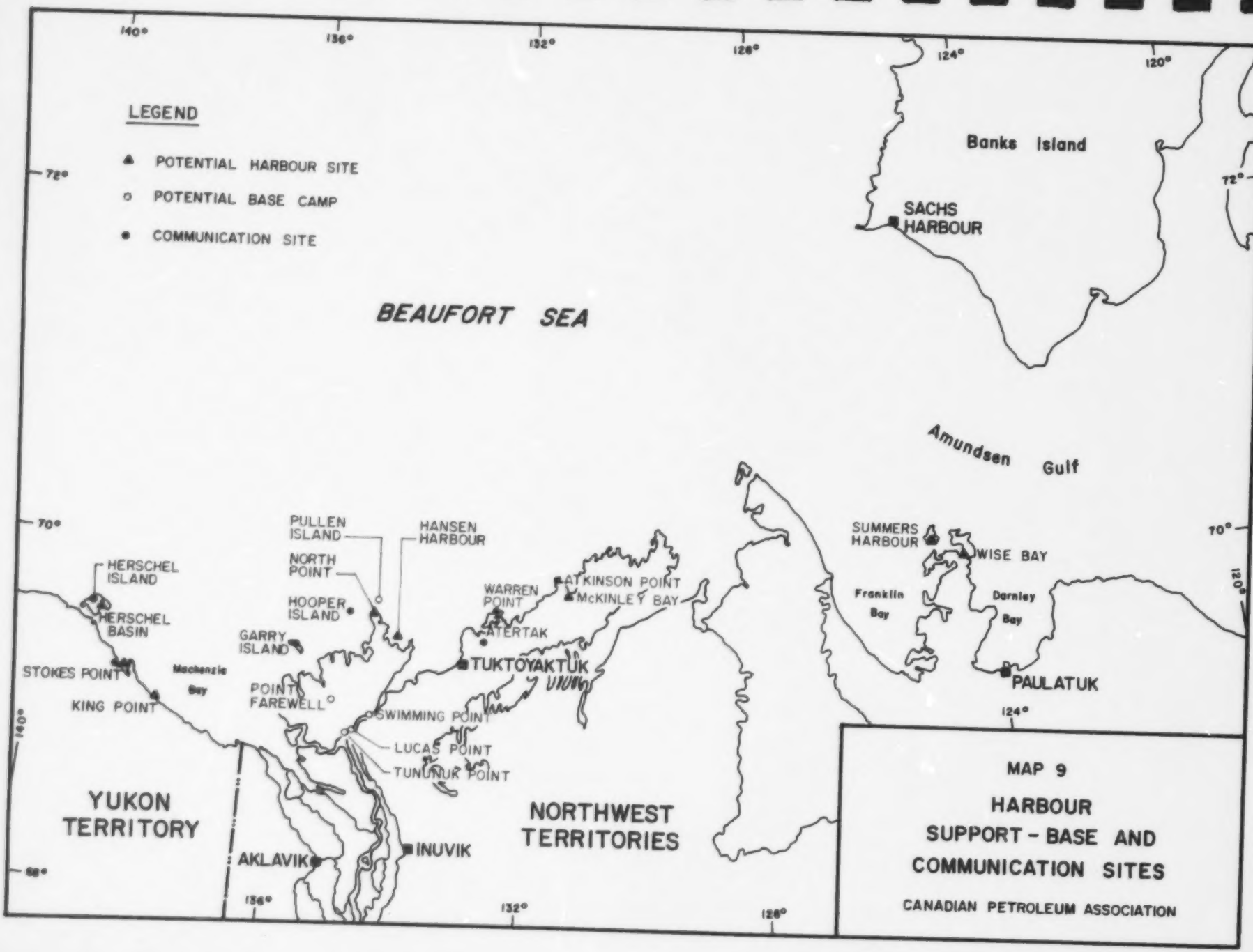
- areas suited for use as base camps, staging areas or harbours;

- river channels and areas used for transportation; and

- areas suited for the installation and use of communications equipment.

During past periods of exploration drilling in the planning region, a number of base-camps and staging areas were established. These sites were selected and developed because they were adjacent to transportation routes, close to drilling activity and suitable, in terms of terrain features, for development and industrial use. Those same features will make use of the areas attractive once again as petroleum development proceeds.

Movement of equipment and materials to oil and gas discovery sites in the Delta region has in the past been accomplished using barge transport along river channels and ground-based truck traffic over ice and snow roads. Offshore development has been supported by marine vessels. Those same modes of transport will continue to be essential for oil and gas activity in the region. Channels used by barges and winter road alignments now in use are land areas of considerable importance for oil and gas development.



MAP 9

HARBOUR SUPPORT - BASE AND COMMUNICATION SITES

CANADIAN PETROLEUM ASSOCIATION

Offshore development will depend upon efficient communication and accurate navigation. Those two elements of offshore operation have in the past depended upon the use of communication towers established along the Beaufort Sea coast. Continued use, and possibly expansion, of that communication network will aid future oil and gas activity in offshore areas.

An additional and important aspect of offshore operations is access to secure and strategically located mooring areas for vessels. Suitable sites along the Beaufort Sea coastline are in short supply. Sites used in the past will likely be in demand during future development.

The following section lists and briefly describes land areas of special importance to oil and gas development in the planning region. Numbers associated with each item match those appearing on 1:250,000 scale maps submitted separately to the Commission.

ITEM #A1 - SWIMMING POINT STAGING AREA

- Operator - Gulf Canada Resources Limited and potentially others.
- Swimming Point has been used previously as a staging area and base camp for petroleum exploration in the Mackenzie Delta region and has been identified as the possible site of an "industry gas plant" (see Item #47).
- Future use of Swimming Point will be based on the site's ideal location adjacent to the East Channel of the Mackenzie River and the site's previous successful use.
- Facilities put in place at Swimming Point could include docks, storage areas, tank farms and camps to house personnel. An air strip is currently in place.
- For additional information contact:

  Mr. Brian Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P 0H6. Telephone (403) 237-3737.

- Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

ITEM #A2 - LUCAS POINT STAGING AREA

- Operator - Gulf Canada Resources Limited.
- Lucas Point is located along the East Channel of the Mackenzie River. An area of several ha at the site was used in previous years as a staging and storage area to support exploration drilling. Future drilling in the delta area may result in a re-activiation of the site.
- The amount of land that might be involved in future use of the Lucas Point site would be approximately 5 ha.
- Facilities at a future Lucas Point staging area would include wharves, stockpile areas and a small camp.
- Use of the site would likely be intermittent and would depend on the extent of oil and gas activity in the region.
- For further details contact Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

ITEM #A3 - TUNUNUK POINT STAGING AREA

- Exploration drilling in the Mackenzie Delta area was supported in the past from a staging area and base camp operation at Tununuk Point called Bar-C. An air strip, storage yards, docks and a tank farm were established during periods of prior use.
- Successful use of the Bar-C site in the past and its location along the main Mackenzie River navigational channel will make future use desirable.
- Facilities put in place during periods of future use would likely be similar to those previously established.
- For additional information contact Mr. Brian Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P 0H6. Telephone (403) 237-3737.

ITEM #A4 - ICE ROAD - TUKTOYAKTUK TO HERSCHEL BASIN

- Operator - Gulf Canada Resources Limited
- This road is used to re-supply marine vessels moored at Herschel Basin.

- The road follows frozen river channels and traverses sea ice along the west shore of Shallow Bay.
- A 10 m wide travel surface is maintained during the period of use.
- The road is prepared and used during the period February through April.
- For further information contact Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

ITEM #A5 - OVERLAND SNOW/ICE ROAD FROM KING POINT TO KAY POINT

- Operator - Gulf Canada Resources Limited.
- This overland alternative to a section of the ice road from Tuktoyaktuk to Herschel Island (see Item #A4) is used when ice conditions along the west side of Shallow Bay curtail travel.
- The snow/ice road is prepared by packing snow along a 10 m wide right-of-way. Total land involved amounts to approximately 97 ha.
- For further details contact Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

ITEM #A6 - ICE ROAD FROM TUK TO MCKINLEY BAY

- Operator - Amoco Canada Petroleum Company Ltd.
- This ice road is used to re-supply marine vessels moored at McKinley Bay as well as the McKinley Bay harbour facility (see Item #A19).
- The road is prepared and used during the period March through early May.
- For further details contact Mr. R. Hoos, Amoco Canada Petroleum Company Ltd., Box 200, Station M, Calgary, Alberta T2P 2H8. Telephone (403) 231-6959.

ITEM #A7 - RICHARDS ISLAND ICE ROADS

- Operators - Shell Canada Limited, Esso Resources Canada Limited and others.
- Activity at and near the several discovery sites on Richards Island has been supported in the past by truck traffic along frozen river

channels. Current operations in the area also use these channel roadways.

- Snow is cleared from channel areas and the roads are used as required during late winter.

- For further information contact:

  Mr. A.B. Anderson, Senior Staff Petroleum Engineer, Oil and Gas Business Development, Shell Canada Limited, 400-4th Avenue S.W., P.O. Box 100, Station M, Calgary, Alberta T2P 2H5. Telephone (403) 232-3257.

  Mr. Brian Dodd, Esso Resources Canada Limited, 237-4th Avenue S.W., Calgary, Alberta T2P 0H6. Telephone (403) 237-3737.

ITEM #A8 - HERSCHEL ISLAND COMMUNICATION TOWER SITE

- Operator - Gulf Canada Resources Limited

- The communication tower site on Herschel Island is currently in use under a land use permit that is renewed annually.

- Approximately 140 m^2 of land is directly affected by the communication facility which consists of 30 metre high tower and a propane powered generator.

- For further details contact Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

ITEM #A9 - STOKES POINT AIRPORT AND COMMUNICATION TOWER

- Operator - Gulf Canada Resources Limited

- A communication tower and airstrip at Stokes Point was used previously to support offshore exploration. Currently, the communication tower is dismantled, but Gulf Canada Resources Limited continues to hold a "licence of occupation" from Parks Canada and uses the airstrip to move personnel travelling to and from vessels moored in Herschel Basin. Future offshore activity in the western Beaufort will make use of the site desirable.

- Plans for future use are preliminary and are dependent upon the nature of future development, but use of the site in the past for communication support makes similar use in the future a likelihood.

- For further details contact Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

ITEM #A10 - GARRY ISLAND COMMUNICATION SITE

- Operator - Gulf Canada Resources Limited
- A communications site on Garry Island has been used to support offshore exploration and would be useful to offshore activity in future. Use of the site is currently approved by land use permit and a lease has been applied for. An 85 m tower is presently in place.
- Land directly affected by use of the communications site amounts to 140 m^2. A generator and 30,000 gallons of fuel is stored at the site. The generator and comunications tower are operated intermittently.
- Operations at the site consist of infrequent visits using helicopters and replenishment of fuel supplies every third or fourth year.
- Use of the site could be expected to last for the duration of oil and gas development in the region (30 plus years).
- Plans for using the site are general in nature and based in part on the site's past and current use. Future use will depend upon the nature of oil and gas activity and the availability/use of alternate communications facilities.
- For further details contact Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

ITEM #A11 - HOOPER ISLAND COMMUNICATION TOWERS

- Operators - Gulf Canada Resources Limited and Amoco Canada Petroleum Company Ltd.
- An 85 m communications tower operated by Gulf Canada Resources Limited is presently in place on Hooper Island. The tower and associated power generation and storage facilities involves land totalling 140 m^2.
- A second 85 m tower on Hooper Island is operated by Amoco Canada Petroleum Company Ltd. Amoco's tower is accompanied by two trailers housing electronic equipment and a power generator. Bermed tanks hold 4,000 - 8,000 gallons of diesel fuel for operation of the generator. Tower, trailers and fuel storage

facilities occupy approximately 2 ha of land. Fuel is transported to the site over winter ice roads and helicopters are used to reach the site for repairs and maintenance on a year-round basis.

- Lease and/or permit agreements with the Department of Indian and Northern Affairs govern current use of the two sites.

- Plans for future use are preliminary and are based on past and current successful use.

- For further details contact:

  Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

  Mr. R. Hoos, Amoco Canada Petroleum Company Ltd., Box 200, Station M, Calgary, Alberta T2P 2H8. Telephone (403) 231-6959.

ITEM #A12 - ATERTAK COMMUNICATION SITE

- Operator - Amoco Canada Petroleum Company Ltd.

- An existing comunication site at Atertak will likely be maintained to support ongoing offshore exploration and development.

- A tower, two trailers and bermed fuel storage (4,000 - 8,000 gallons of diesel) occupy less than 5 ha at the unmanned site. Atertak is supplied in winter, using a winter road, and is serviced year-round by helicopter.

- Future operations will be similar to those currently under way. Use of the site can be expected to continue for the duration of offshore oil and gas activity (30 plus years).

- Plans for future use of the site are preliminary.

- For further information contact Mr. R. Hoos, Amoco Canada Petroleum Company Ltd., Box 200, Station M, Calgary, Alberta T2P 2H8. Telephone (403) 231-6959.

ITEM #A13 - ATKINSON POINT COMMUNICATION SITE

- Operator - Amoco Canada Petroleum Company Ltd.

- An existing comunication site at Atkinson Point will likely be maintained to support ongoing offshore exploration and development.

- Facilities at the site and plans for future use are similar to those outlined for the Atertak and Hooper Island communications sites (see Items #A11 and #A12).

- For further information contact Mr. R. Hoos, Amoco Canada Petroleum Company Ltd., Box 200, Station M, Calgary, Alberta T2P 2H8. Telephone (403) 231-6959.

ITEM #A14 - WARREN POINT COMMUNICATION SITE

- Operator - Amoco Canada Petroleum Canada Ltd.

- Communication sites along the Tuktoyaktuk Peninsula, in addition to the existing facilities at Atertak and Atkinson Point, may be required to support future offshore oil and gas development.

- Establishment of a communications site at Warren Point was considered during the execution of previous offshore drilling programs by Dome Petroleum. The site is particularly well suited for a communications facility.

- Land used, facilities put in place, and operational activities at Warren Point would be similar to those outlined for the existing communication site at Atertak (see Item #A12).

- For further information contact Mr. R. Hoos, Amoco Canada Petroleum Company Ltd., Box 200, Station M, Calgary, Alberta T2P 2H8. Telephone (403) 231-6959.

ITEM #A15 - PAULINE COVE/HERSCHEL BASIN HARBOUR

- Operator - Gulf Canada Resources Limited and Amoco Canada Petroleum Company Ltd.

- The deep water basin lying south and east of Herschel Island has been used for a number of years as a moorage area for marine vessels involved in offshore exploration. Given the site's ideal physical characteristics and successful past use, it is very likely to be used for similar purposes in order to support future offshore oil and gas development.

- Shore-based facilities have not been a part of the use of Herschel Basin and none are currently contemplated.

- Future use of the site may involve floating fuel storage, storage of floating caissons and other offshore construction equipment and materials, and the development of an offshore marine base.

- Activity at the site can be expected year-round for the duration of offshore oil and gas activity in the region (30 plus years).

- Use of various portions of the basin area (see 1:250,000 scale maps) is dependent in part upon the kinds of vessels being moored as well as the schedule for future use. Consequently, a relatively large area, extending from the southeast shore of Herschel Island to Kay Point, has been identified for possible use.

- Plans for future use of Herschel Basin are general in nature and are not based on detailed study.

- For further or updated information, contact:

  Mr. R. Hoos, Amoco Canada Petroleum Company Ltd., Box 200, Station M, Calgary, Alberta T2P 2H8. Telephone (403) 231-6959.

  Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

ITEM #A16 - KING POINT DEEP WATER HARBOUR/SUPPORT BASE

- King Point is a preferred location for a deep-water year-round port facility on the Beaufort Sea coast.

- The site offers deep-water access close inshore.

- Development at the site would likely involve up to 75 ha of land onshore and would include an airstrip.

- The facility would be used for refuelling, servicing, repair, storage and trans-shipment of equipment and construction materials for offshore development.

- King Point was selected as an ideal location after examination of a number of alternatives. Development and use of the site described above, however, is conceptual in nature. For additional information see the Beaufort Sea EIS (Dome, Esso, Gulf, et al. 1982; page 5.29).

- For further information contact:

  Mr. Bruce Smedley, Monenco Consultants Limited, 400-Monenco Place, 801-6th Avenue, Calgary, Alberta T2P 3W3. Telephone (403) 298-4596. Fax (403) 298-4596.

  Mr. R. Hoos, Amoco Canada Petroleum Company Ltd., Box 200, Station M, Calgary, Alberta T2P 2H8. Telephone (403) 231-6959.

ITEM #A17 - SUMMERS HARBOUR

- Operators - Amoco Canada Petroleum Company Ltd. and Gulf Canada Resources Limited.

- Summers Harbour was used as a moorage and marine staging area in support of offshore exploratory drilling in the eastern Beaufort Sea. Given its location and site characteristics, future use for similar purposes is likely.

- Onshore facilities are not planned at Summers Harbour and operational activity would likely involve only the presence of large marine vessels. Assembly of offshore structures may also occur.

- Activity would likely peak during the summer, but moored vessels might be present year-round. Use of the site could be expected to occur intermittently for the duration of oil and gas activity in the region (30 plus years).

- Plans for use of Summers Harbour are tentative and are based on past successful use. The degree of future use will depend upon the nature of development in any particular year and the use/availability of alternate harbours.

- For further or updated information contact:

  Mr. R. Hoos, Amoco Canada Petroleum Company Ltd., Box 200, Station M, Calgary, Alberta T2P 2H8. Telephone (403) 231-6959.

  Mr. Terry Antoniuk, Gulf Canada Resources Limited, Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

ITEM #A18 - WISE BAY HARBOUR

- Operators - Amoco Canada Petroleum Company Ltd. and Gulf Canada Resources Limited.

- Wise Bay has in the past been used as a marine staging area and as a temporary moorage for offshore vessels. The site's location and characteristics make it probable that it will be used in a similar capacity during future development.

- No onshore facilities are planned and permanent structures would not likely be placed on the sea bottom.

- Activity at Wise Bay would consist simply of the presence of marine vessels and possibly the assembly of offshore structures.

- Use of the site would likely occur intermittently throughout oil and gas development in the region (30 plus years).

- Plans for use of Wise Bay are tentative and general in nature. More elaborate plans or intense use of the site might occur if other harbours in the area are not available.

- For further or updated information contact:

  Mr. R. Hoos, Amoco Canada Petroleum Company Ltd., Box 200, Station M, Calgary, Alberta T2P 2H8. Telephone (403) 231-6959.

  Mr. Terry Antoniuk, Gulf Canada Resources Limited, Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

ITEM #A19 - MCKINLEY BAY SUPPORT BASE AND MEDIUM DRAFT HARBOUR

- Operator - Amoco Canada Petroleum Company Ltd.

- A 63 ha artificial island in McKinley Bay is presently in place as well as a mooring basin of 100 ha and an access channel.

- In future, an expanded facility would likely be constructed as a supply, maintenance, repair and refuelling facility for vessels involved in offshore development. Accommodation for base and transient personnel would also be put in place, as would an STOL airstrip, drydock and winter mooring basin. A mooring basin of 40 ha may be required.

- All facilities would be placed on an expanded island, formed from sand dredged to create the harbour and mooring basin. Construction/dredging activities would take place during the open-water period and the facility would operate year-round.

- Future development outlined is conceptual only and no detailed planning studies have been completed. A brief description of future development and use is included in the Beaufort Sea EIS (Dome, Esso, Gulf et al. 1982; page 5.28).

- For further information contact Mr. R. Hoos, Amoco Canada Petroleum Company Ltd., Box 200, Station M, Calgary, Alberta T2P 2H8. Telephone (403) 231-6959.

ITEM #A20 - POINT FAREWELL STAGING AREA

- Past exploration activity in the Mackenzie Delta, particularly that in the Niglintgak and Kumak discovery areas, was supported from a staging area and base camp at Point Farewell.

- Successful use of the site in the past and its strategic location will make future use desirable.

- For additional information contact A.B. Anderson, Senior Staff Petroleum Engineer, Oil and Gas Business Development, Shell Canada Limited, 400-4th Avenue S.W., Calgary, Alberta T2P 2H5. Telephone (403) 232-3257.

ITEM #A21 - NORTH POINT ON RICHARDS ISLAND

- North Point (also known as North Head) is a likely landfall for an offshore oil pipeline.

- In the CPA's May 1988 report, North Point was identified as the likely location for an "industrial" site; one which would be used for oil terminal and pumping facilities as well as a support base for a variety of offshore operations. Those expectations for North Point have been revised in light of a logistics study which indicated existing facilities at Tuktoyaktuk and Inuvik will be sufficient to support offshore oil development.

- Given current information and preliminary planning, it seems likely only oil receiving and pumping facilities will be required at North Point.

- Future facilities at North Point may include tankage for oil storage, a pumping station, camp facilities for a small operating staff and emergency use, a communication tower and possibly an air strip.

- Plans outlined above are preliminary.

- For additional information contact Mr. Terry Antoniuk, Gulf Canada Resources Limited, P.O. Box 130, Calgary, Alberta T2P 2H7. Telephone (403) 233-3192.

REFERENCES CITED

Canadian Petroleum Association. 1987.
Environmental Code of Practice. Document prepared for use by member companies by the Canadian Petroleum Association, Calgary, Alberta.

Canadian Petroleum Association. 1988.
Petroleum-related activity and resource potential within the Mackenzie Delta-Beaufort Sea land use planning area. Report prepared for submission to the Mackenzie Delta-Beaufort Sea Regional Planning Commission by R.A. Owens Environmental Services Ltd., Calgary, Alberta.

Dome Petroleum Limited, Esso Resources Canada Limited and Gulf Canada Resources Inc. 1982. Mackenzie Delta-Beaufort Sea environmental impact statement - Volume 2 - development systems. Report prepared on behalf of holders of oil and gas lands in the Mackenzie Delta-Beaufort Sea region.

Mackenzie Delta-Beaufort Sea Regional Land Use Planning Commission. 1988. Annual report. Prepared for the Northwest Territories Land Use Planning Commission, Yellowknife, N.W.T.

A P P E N D I X 1

THE CANADIAN PETROLEUM ASSOCIATION'S ENVIRONMENTAL CODE OF PRACTICE

APPENDIX 2

THE CANADIAN PETROLEUM ASSOCIATION'S ENVIRONMENTAL CODE OF PRACTICE

Policy Statement

Companies are committed to protecting the environment and to maintaining public health and safety during all phases of operation of the petroleum industry. They do so on behalf of their shareholders and employees, and on behalf of present and future generations of Canadians.

Guiding Principles

Planning - Companies will assess the potential effects of their projects and will integrate protective measures into the planning process to prevent or reduce impacts upon the environment and on public health and safety.

Consultation - Companies will provide relevant information in a timely fashion to the public and to governments with respect to corporate policies and activities and will be responsive and sensitive to community concerns.

Compliance - Companies will comply with applicable laws and regulations and will adhere to the intent of industry guidelines.

Corrective Action - Environmental damage caused by company activities will be corrected in a timely and efficient manner.

Emergency Response - Companies will implement programs to minimize the consequences of emergency events by ensuring prompt and effective response.

Research - Companies will encourage and support research relevant to improving industry's ability to protect the environment and maintain public health and safety.

Companies will apply the expertise necessary to implement this Environmental Code of Practice and will require contract services to operate in a manner consistent with corporate policies.

Implementation Schedule

The CPA has recommended that all member companies implement the Code by the end of 1989. To assist in this task, the Environmental Planning and Management Committee of CPA has re-written its Environmental Operating Guidelines so that they reflect current legislation and good operating practice. In addition, the association held a workshop in the fall of 1988 for operations managers to become familiar with the revised guidelines and what they represent. Companies are asked to amend or develop corporate

environmental policies consistent in intent with the Code and to assign responsibility for these matters.

Copies of the CPA's Environmental Code of Practice may be obtained by contacting Mr. Ian Scott, Canadian Petroleum Association, #3800, 150-6th Avenue S.W., Calgary, Alberta T2P 3Y7. Telephone (403) 269-6721.

Source: Canadian Petroleum Association Annual Report, 1987.

A P P E N D I X 2

PETROLEUM DISCOVERIES
IN THE
MACKENZIE DELTA-BEAUFORT SEA
LAND USE PLANNING REGION

APPENDIX 2

PETROLEUM DISCOVERIES IN THE MACKENZIE DELTA-BEAUFORT SEA LAND USE PLANNING REGION

Imp. ADGO			P-25	oil and gas discovery
	Lat.	69.41579		
	Long.	135.84165		
Dome et al ADLARTOK			P-09	oil discovery
	Lat.	69.64778		
	Long.	137.75778		
Gulf et al AMAULIGAK			J-44	oil discovery
	Lat.	70.0584		
	Long.	133.7125		
Esso Home PCI et al AMERK			O-09	gas discovery
	Lat.	69.9823		
	Long.	133.5140		
Imp. ARNAK			L-30	oil and gas discovery
	Lat.	69.82904		
	Long.	133.87254		
IOE ATKINSON			H-25	gas discovery
	Lat.	69.73889		
	Long.	131.8350		
Sun CCL BVC et al GARRY			G-07	gas discovery
	Lat.	69.43972		
	Long.	135.51556		
Sun SOBC BVX et al GARRY			P-04	oil and gas discovery
	Lat.	69.39606		
	Long.	135.50539		
Esso PCI Home et al HANSEN			G-07	oil and gas discovery
	Lat.	69.6056		
	Long.	134.01992		

Dome et al HAVIK			B-41	oil discovery
	Lat.	70.3364		
	Long.	132.2181		
Gulf Mobil IKHIL			I 37	gas discovery
	Lat.	68.77611		
	Long.	134.13056		
Dome Imp. IMNAK			J-29	oil discovery
	Lat.	69.14472		
	Long.	133.10139		
Imp. IOE et al ISSERK			E-27	gas discovery
	Lat.	69.93891		
	Long.	134.36996		
Esso Gulf ISSUNGNAK			O-61	oil and gas discovery
	Lat.	70.01667		
	Long.	134.43583		
Esso Pex Home et al ITIYOK			I-27	oil and gas discovery
	Lat.	69.9444		
	Long.	134.0887		
Imp. IVIK			J-26	oil and gas discovery
	Lat.	69.59500		
	Long.	134.34388		
Imp. IVIK			K-54	oil discovery
	Lat.	69.5600		
	Long.	134.4836		
Esso Home et al KADLUK			O-07	gas discovery
	Lat.	69.7801		
	Long.	136.0205		
Gulf-Mobil KAMIK			D-58	oil and gas discovery
	Lat.	68.95366		
	Long.	133.49762		
Dome Hunt KENALOOAK			J-94	gas discovery
	Lat.	70.72889		
	Long.	133.9744		

Gulf et al KIGGAVIK			A-43	gas discovery
	Lat.	69.8695		
	Long.	135.9214		
Dome KOAKOAK			O-22	oil discovery
	Lat.	70.3652		
	Long.	134.1133		
Hunt Dome KOPANOAR			M-13	oil and gas discovery
	Lat.	70.38205		
	Long.	09282		
Shell KUGPIK			O-13	oil discovery
	Lat.	68.88056		
	Long.	135.30417		
Shell KUMAK			J-06	oil and gas discovery
	Lat.	69.26000		
	Long.	135.01606		
Imp. IOE MALLIK			L-38	gas discovery
	Lat.	69.46222		
	Long.	134.65694		
IOE MAYOGIAK			J-17	oil discovery
	Lat.	69.44500		
	Long.	132.80345		
Esso PCI Home et al MINUK			I-53	gas discovery
	Lat.	69.70965		
	Long.	136.45885		
Dome et al NEKTORALIK			K-59	oil discovery
	Lat.	70.47534		
	Long.	136.28076		
Imp. NETSERK			F-40	oil and gas discovery
	Lat.	69.65631		
	Long.	135.90583		

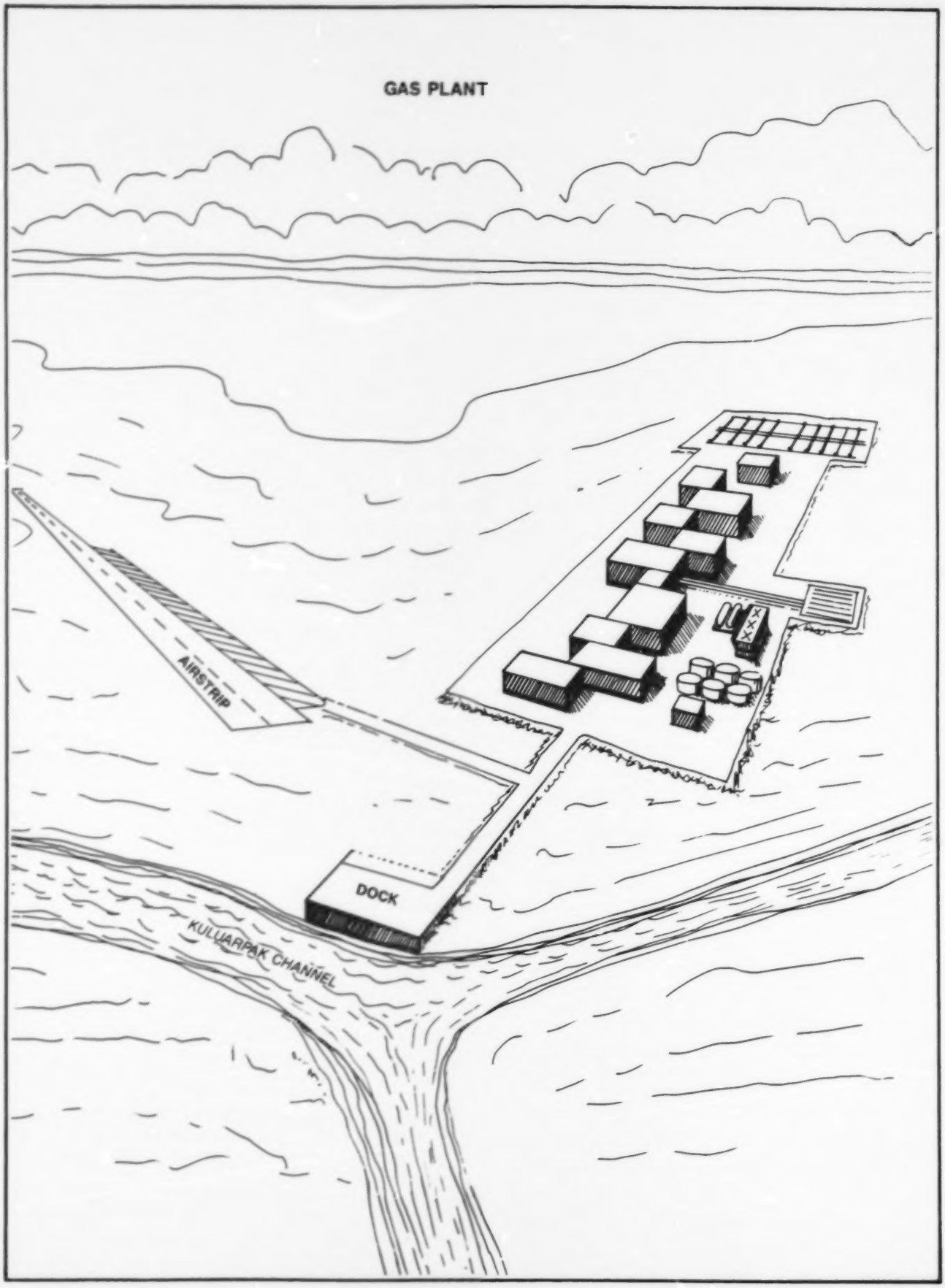
Dome NERLERK			M-98	oil and gas discovery
	Lat.	70.46367		
	Long.	133.49631		
Shell NIGLINTGAK			H-30	oil and gas discovery
	Lat.	69.32255		
	Long.	135.34314		
ESSO et al NIPTERK			L-19	oil and gas discovery
	Lat.	69.8106		
	Long.	135.2982		
Gulf-Mobil PARSONS			F-09	gas discovery
	Lat.	68.97611		
	Long.	133.52583		
Sun BVX et al PELLY			B-35	gas discovery
	Lat.	69.56969		
	Long.	135.39092		
Gulf et al PITSUILAK			A-05	oil discovery
	Lat.	69.9039		
	Long.	136.7597		
Gulf Imperial Shell REINDEER			F-36	gas discovery
	Lat.	69.08889		
	Long.	134.65000		
Gulf-Mobil SIKU			C-55	gas discovery
	Lat.	69.06780		
	Long.	133.73278		
IOE TAGLU			G-33	gas discovery
	Lat.	69.37166		
	Long.	134.89354		
Dome Gulf TARSIUT			A-25	oil and gas discovery
	Lat.	69.90278		
	Long.	136.33889		

Dome et al TINGMIARK			K-91	gas discovery
	Lat.	70.17672		
	Long.	132.48226		
Gulf Imperial Shell TITALIK			K-26	gas discovery
	Lat.	69.09167		
	Long.	135.10417		
Esso PCI Home et al TUK (Tuk Cretaceous)			G-39	oil discovery
	Lat.	69.30639		
	Long.	133.14525		
Esso PCI Home et al TUK (Tuk Tertiary)			M-09	gas discovery
	Lat.	69.3142		
	Long.	133.0351		
Dome et al UKALERK			C-50	gas discovery
	Lat.	70.15155		
	Long.	132.73569		
Esso Pex WEST ATKINSON			L-17	oil discovery
	Lat.	69.7761		
	Long.	132.0757		
Gulf Mobil YAYA			A-28	gas discovery
	Lat.	69.28633		
	Long.	134.59081		
Gulf Mobil YAYA			P-53	gas discovery
	Lat.	69.21389		
	Long.	134.71250		

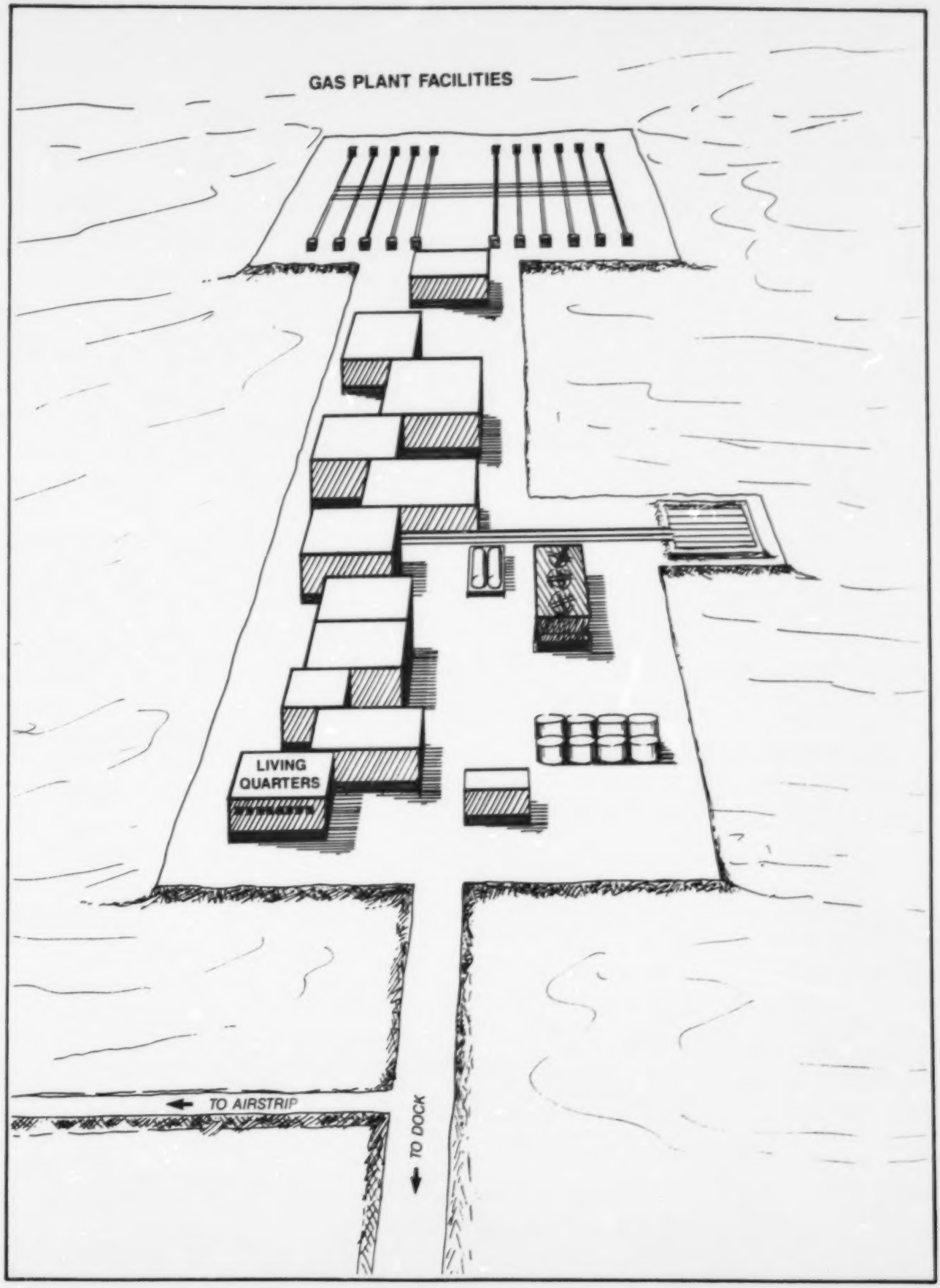
APPENDIX 3

ILLUSTRATIONS OF OIL AND GAS DEVELOPMENT FACILITIES

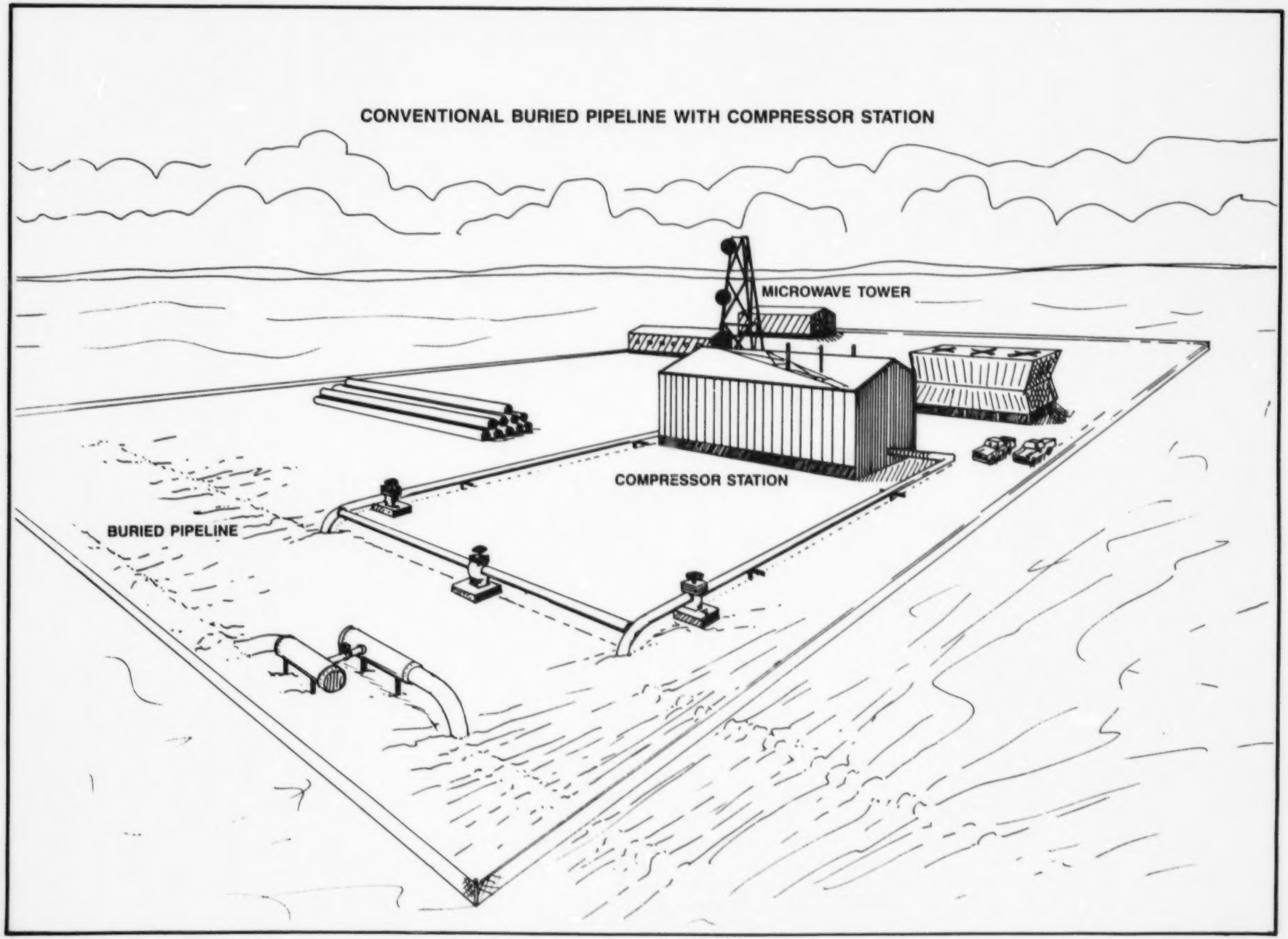
GAS PLANT - This artist's sketch shows a possible layout for the Taglu Gas Plant. Included in the drawing are the major components of a gas processing facilty. A dock and airstrip appear in the foreground and living quarters, wells, well pads and process and utility buildings are shown in the main plant area.


GAS PLANT
AIRSTRIP
DOCK
KULUARPAK CHANNEL

GAS PLANT FACILITIES - This sketch presents a closer view of the gas plant illustrated in the previous drawing. Buildings in the foreground would house staff and function as warehouses and maintenance workshops. Buildings in the middle of the sketch would house processing equipment. Aerial coolers, storage tanks and a ground flare are also shown and a well pad and production wells appear in the background. All of the facilities are situated on a gravel pad.


GAS PLANT FACILITIES
LIVING QUARTERS
TO AIRSTRIP
TO DOCK

COMPRESSOR STATION - This artist's sketch shows a typical gas pipeline compressor station. Incoming and outgoing buried pipelines are indicated by the slightly disturbed ground surface in the foreground. Pig traps and valve assemblies are also shown in the foreground. Buildings housing compression and cooling equipment together with pipe storage racks appear in the centre of the sketch. Maintenance and warehouse building appear in the background.

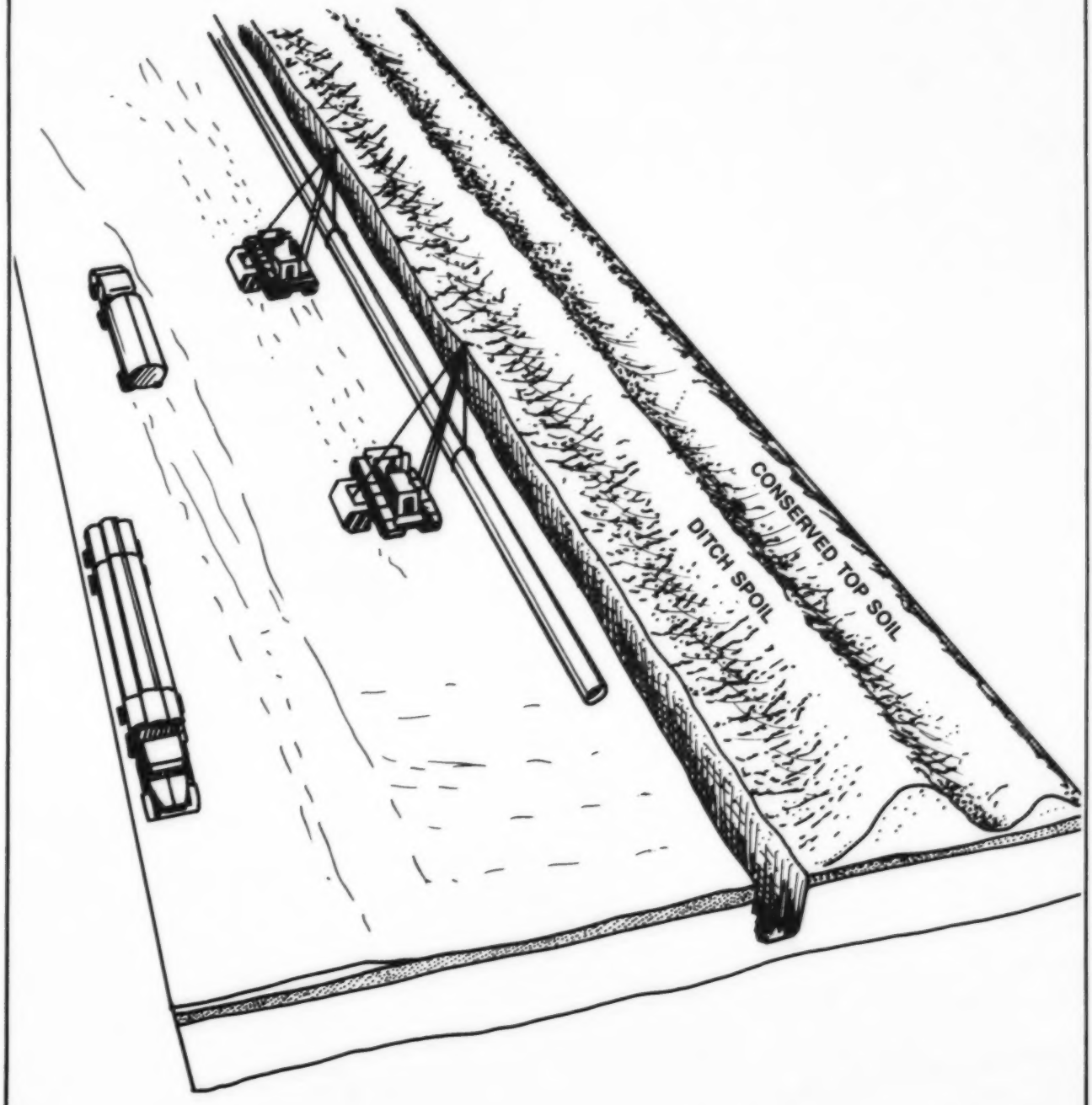

CONVENTIONAL BURIED PIPELINE WITH COMPRESSOR STATION
MICROWAVE TOWER
COMPRESSOR STATION
BURIED PIPELINE

ELEVATED PIPELINE - The elevated pipeline shown in this sketch illustrates a pipe placement concept used extensively at petroleum facilities on the North Slope of Alaska. Similar elevated placement of pipe for gathering systems required in the planning region may offer a number of advantages over conventional pipe burial.

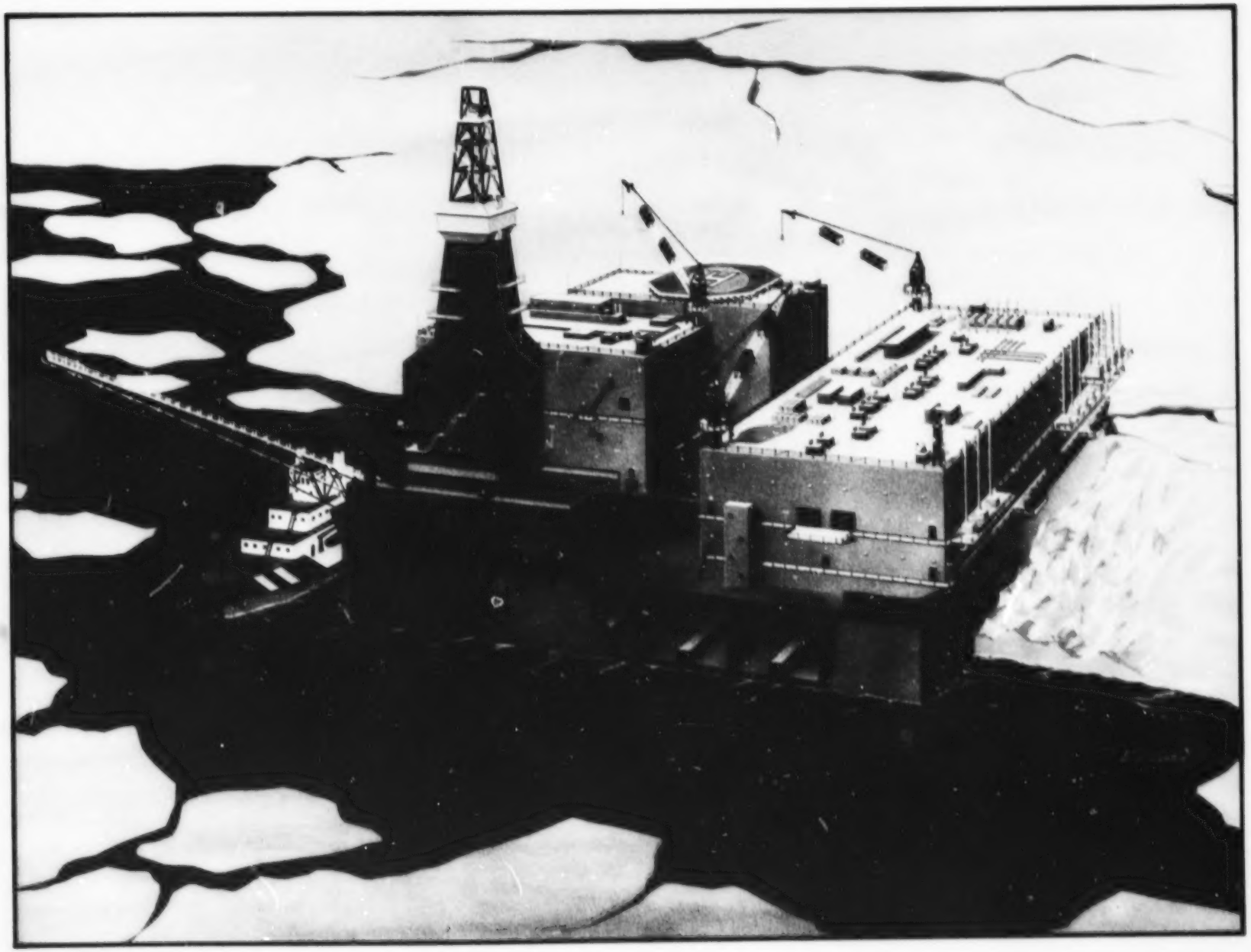
ELEVATED PIPELINE

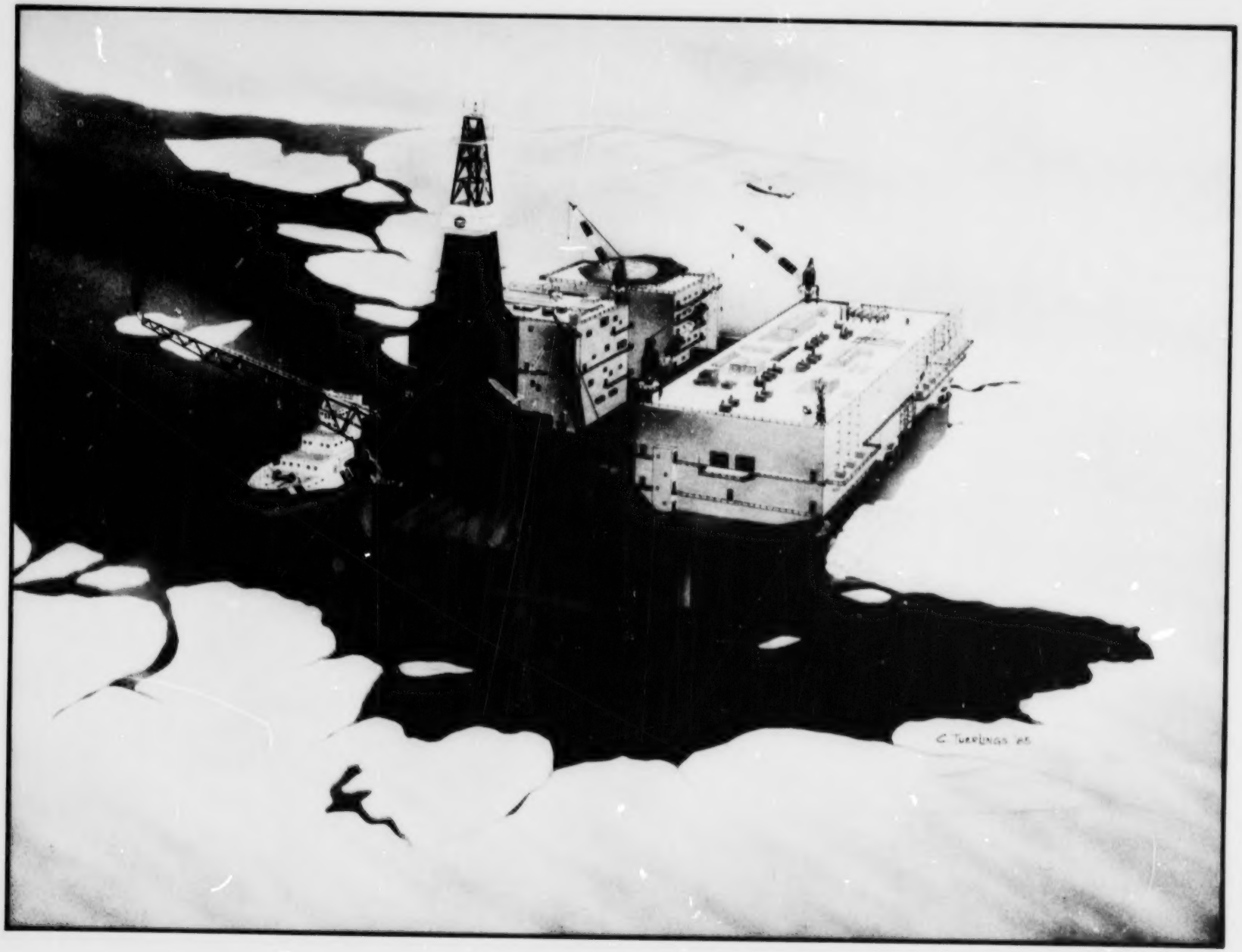
ARCTIC CONSTRUCTION OF A BURIED PIPELINE - This sketch depicts construction activity as it might appear along the right-of-way for a buried transmission pipeline. Construction would take place in winter on frozen ground and a snow or ice road would be used for travel along the pipeline route. The top most layers of soil and vegetation over the ditch would be conserved separately from deeper layers and would be replaced as part of the efforts to revegetate areas affected by construction.

ARCTIC CONSTRUCTION-BURIED PIPELINE



OFFSHORE PRODUCTION FACILITIES - This and the following illustration show what an offshore production facility might look like. The facility shown here is situated atop a monolithic structure on a berm (MSOB) while that in the following drawing (turn page) is supported by a caisson retained structure. Both structures offer a secure platform from which production drilling and production activity could take place.





APPENDIX 4

CHECKLIST OF MAPPED AREAS

APPENDIX 4

CHECKLIST OF MAPPED AREAS

DISCOVERY/PRODUCTION/PROCESSING SITES

1 - Adgo offshore oil and gas discovery

2 - Adlartok offshore oil discovery

3 - Amauligak offshore oil and gas discovery

4 - Amerk offshore gas discovery

5 - Arnak offshore oil and gas discovery

6 - Atkinson onshore oil discovery

7 - Garry South onshore oil and gas discovery

8 - Garry North onshore gas discovery

9 - Hansen onshore oil and gas discovery

#10 - Havik offshore oil discovery

#11 - Ikhil onshore gas discovery

#12 - Imnak onshore oil discovery

#13 - Isserk offshore gas discovery

#14 - Issungnak offshore oil and gas discovery

#15 - Itiyok offshore oil and gas discovery

#16 - Ivik J-26 onshore oil and gas discovery

#17 - Ivik K-54 onshore oil discovery

#18 - Kadluk offshore gas discovery

#19 - Kamik onshore oil discovery

#20 - Kiggavik offshore gas discovery

#21 - Koakoak offshore oil and gas discovery

#22 - Kopanoar offshore oil and gas discovery

CHECKLIST OF MAPPED AREAS
(continued...)

#23 - Kugpik onshore oil discovery

#24 - Kumak onshore oil and gas discovery

#25 - Mallik onshore gas discovery

#26 - Mayogiak onshore oil discovery

#27 - Minuk offshore gas discovery

#28 - Nektoralik offshore oil discovery

#29 - Netserk offshore gas discovery

#30 - Nerlerk offshore oil and gas discovery

#31 - Niglintgak onshore oil and gas discovery

#32 - Nipterk offshore oil and gas discovery

#33 - Parsons Lake onshore gas discovery

#34 - Pelly onshore gas discovery

#35 - Pitsuilak offshore oil discovery

#36 - Reindeer onshore gas discovery

#37 - Siku onshore gas discovery

#38 - Taglu onshore gas discovery

#39 - Tarsiut offshore oil and gas discovery

#40 - Tingmiark offshore gas discovery

#41 - Titalik onshore gas discovery

#42 - Tuk Cretaceous onshore gas discovery

#43 - Tuk Tertiary onshore oil discovery

#44 - Ukalerk offshore gas discovery

#45 - West Atkinson offshore oil discovery

#46 - YaYa onshore gas discovery

#47 - Swimming Point area

CHECKLIST OF MAPPED AREAS
(continued...)

TRANSPORT CORRIDORS

#C1 - Niglintgak to Taglu

#C2 - Taglu to Swimming Point

#C3 - Parsons to the Parsons/mainline junction

#C4 - Kadluk to Taglu

#C5 - Amauligak to Taglu

#C6 - Tuk to Taglu

#C7 - Tuk to Parsons

#C8 - Tuk to Swimming Point

#C9 - Swimming Point to Campbell Hills, south

#C10- Parsons to Swimming Point

#C11- Amauligak to North Point

#C12- North Point to Swimming Point

#C13- Issungnak to Amauligak

#C14- Pitsuilak to North Point

#C15- Adgo to Niglintgak to mainline oil pipeline

#C16- Kugpik to mainline oil pipeline

#C17- West Atkinson to a junction with the mainline oil pipeline

TRANSMISSION PIPELINES

DLP - The Dempster Lateral Gas Pipeline

PGP - The Polar Gas Pipeline

OP - Oil pipeline

CD - Condensate pipeline

MVP - Mackenzie Valley Gas Pipeline

CHECKLIST OF MAPPED AREAS
(continued...)

SPECIAL AREAS

#A1 - Swimming Point staging area

#A2 - Lucas Point staging area

#A3 - Tununuk Point staging area

#A4 - Ice road - Tuktoyaktuk to Herschel Basin

#A5 - Overland snow/ice road from King Point to Kay Point

#A6 - Ice road from Tuk to McKinley Bay

#A7 - Richards Island ice roads

#A8 - Herschel Island communication tower site

#A9 - Stokes Point airport and communication tower

#A10- Garry Island communication site

#A11- Hooper Island communication towers

#A12- Atertak communication site

#A13- Atkinson point communication site

#A14- Warren Point communication site

#A15- Pauline Cove/Herschel Basin harbour

#A16- King Point deep water harbour/support base

#A17- Summers Harbour

#A18- Wise Bay Harbour

#A19- McKinley Bay support base and medium draft harbour

#A20- Point Farewell staging area

#A21- North Point on Richards Island